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Contents.

	PAGE
Forthcoming Events	509
The Progress of the Iron Foundry during 1921	509
The First Steel Foundry in Ireland	510
Determination of Recalescence Points	510
The Problem of Grey Iron Castings.—II.	511
Design, Equipment, and Management of a Foundry	515
The Determination of Manganese in Brass	518
A New Pig-Breaking Machine	519
Patent Specification Abridgments	520
Correspondence	520
Publications Received	520
Trade Talk	521
Iron and Steel Markets	522
Company News	17
Gazette	17
Applications for Trade Marks	17
Personal	17

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTION OF BRITISH FOUNDRYMEN AND THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION

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Forthcoming Events.

Institution of British Foundrymen.

East Midland Branch.—"Foundry Facings," by H. Winterton, on January 28, 1922, at Loughborough.

Coventry Branch.—"Foundry Training," by T. Vickers, on January 11, 1922.

The Progress of the Iron Foundry During 1921.

The year which is just closing has undoubtedly been an outstanding one in the annals of British foundry practice. Commercially it has been hopeless, but technically enormous strides have been made, so much so that an eminent metallurgist recently stated that we were on the eve of a revolution of the industry.

The most important development which has taken place is the formation of the British Cast Iron Research Association, the success of which bears no relation to that of a limited liability company, which depends upon the initiative of its directors. The progress of this Association is based upon the desire to go forward by the foundry industry as a whole, or, in other words, everybody connected with the industry is equally responsible, with their appointed representatives, for its success.

Another equally important event is the granting by the Privy Council of a Royal Charter to the Institution of British Foundrymen, which, additionally to materially adding to the status of the Institution, widens its scope, for its reception allows of its development in any direction, except those specifically prohibited by the wording of the Charter.

The year 1921 has seen the foundation laid for an international foundry exhibition, to be held in June next year at Birmingham, under the joint auspices of the Birmingham Chamber of Commerce, the British Cast Iron Research Association, and the Institution of British Foundrymen. This will be the first time in the history of the British foundry trade that such an attempt has been made, and Mr. Thos. Vickers is to be congratulated as the initiator of the movement.

The interest which is being evinced for the better education of the foundryman has been evidenced during the year by the presentation to the Institution of British Foundrymen of medals substantially for this purpose by Mr. W. Mayer, of Dumbarton, and the National Employers' Federation. The former is to be known as the "Surtees" medal, and is for competition by those attached to the Scottish and Newcastle Branches, and the latter the "Oliver Stubbs," after the present President of the Institution. Full details of this latter medal are not yet available, but the choice of name is a happy one, as it will commemorate for all time the name and work of the first president of the Foundrymen's Association as a chartered institution.

Another innovation has been made by the Institution of British Foundrymen and the American Foundrymen's Association by the interchange of technical Papers to be read at each other's annual conference. Whilst this cannot fail to be of benefit to the two industries, it has the further advantage of cementing the good feeling of the whole of the English-speaking nations.

Finally, the past year has seen THE FOUNDRY TRADE JOURNAL changed from a monthly to a weekly periodical, and as such is unique in the world's foundry industry, as no other country has yet been able to cater weekly for its readers. The rapid presentation of the latest available foundry literature is of no mean advantage to the trade.

We sincerely hope that the foundry and its associated trade will experience during the coming year as much commercial and financial success as there has been technical progress during the past twelve months.

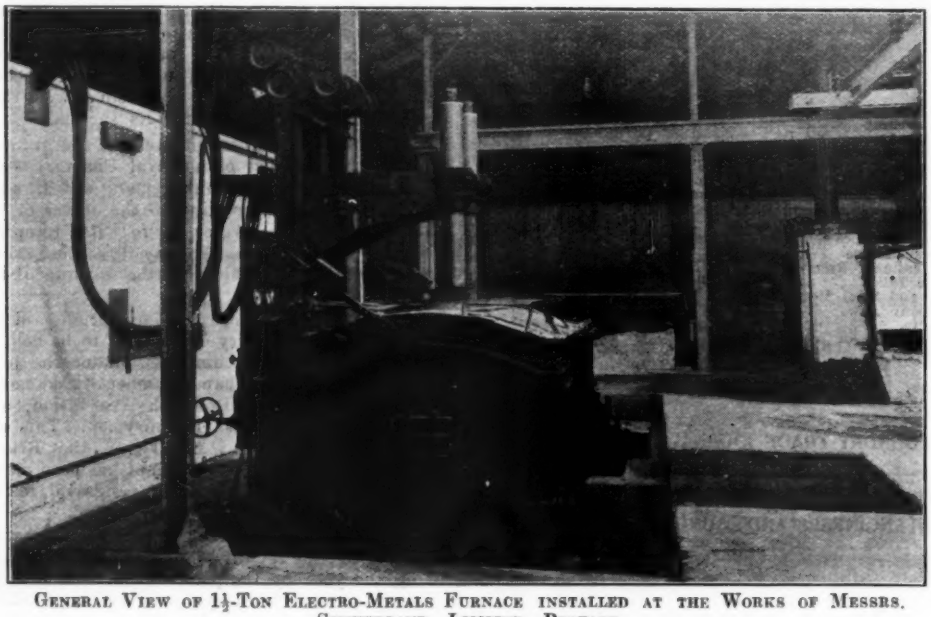
XUM

The First Steel Foundry in Ireland.

At the new steel foundry of Messrs. Sutherland, Ltd., Sydenham Road, Belfast, an electric furnace has been installed, and was placed in commission on December 3, when steel was made for the first time in Ireland.

Messrs. Sutherland's new foundry is situated adjacent to the shipyards, and the foundry building, which is of steel construction, has a floor space of 14,000 sq. ft. The melting equipment consists of a 1½-ton Electro-Metals two-phase furnace of the most recent type. The furnace, which is shown in the illustration, is basic lined and has two 8-in. dia. graphite electrodes which are equipped with economisers on the furnace roof. The electrode control is by hand, the weight of the electrode with its supporting carriage being counterbalanced, whilst the tilting gear is totally enclosed and is motor operated. The furnace, which is connected to transformers having a total capacity of 800 k.v.a. receives its supply from the Belfast Corporation mains, the transformers being designed for 3-phase, 50 cycles, 6,500 volts, on the primary side, whilst the secondary delivers 2-phase current to the furnace at 90 or 70 volts. The transformers are of the self-cooled type manufactured by the British Electric Transformer Company, Limited, Hayes, Middlesex. The switchgear for the control of the transformers is contained in a sheet-steel cubicle, and consists of isolating switch, main oil-switch, and 2-way selector switch, all being suitably interlocked and rendered fool-proof. The switchgear was made by the New Switchgear Construction Company, Limited, Sutton. The furnace is situated at one end of the main bay which is spanned by a 3-ton electrically-operated travelling crane of the Vaughan Crane Company's manufacture.

The moulding and dressing equipment is along the usual lines for steel foundries, and power is furnished for the various machines by gas engines, which also generate the electric current required for the crane and for the tilting motor of the electric furnace. It is believed that the laying down of this plant in Belfast will be of considerable advantage to the engineering industry of Ireland, as all steel castings have hitherto been imported either from Great Britain or America.



General View of 1½-Ton Electro-Metals Furnace installed at the Works of Messrs. Sutherland, Limited, Belfast.

Associated Trading & Engineering Company, Limited.—A petition has been presented by Messrs. H. Barnett & Company, 8, Vine Street, Minories, E.C., for the winding-up of the above company. Messrs. Cochrane and Cripwell, 119, Finsbury Pavement, E.C., solicitors.

Determination of Recalescence Points.

The latest types of apparatus for carrying out scientific experiments in determining the recalescence points for heat treatment were described by by Mr. E. R. Taylor (lecturer to the Birmingham Municipal Technical School) in a lecture delivered before the Birmingham Metallurgical Society on December 8 at the Birmingham Chamber of Commerce, Dr. F. Johnson (President) presiding over a large attendance.

Pointing out that in modern practice in heat treatment it was essential to work to close limits and to use scientific apparatus of the highest precision, the lecturer said that occasionally unexpected failures would occur which might necessitate chemical analysis to discover what changes had taken place in material. A typical example of the times occurred in connection with the treatment of small engine parts, when the right degree of hardness failed to develop, although the composition was quite up to specification. The cause was discovered to be a current of air passing along the bed of the muffle producing a film of oxidation on the surface of the steel. The matter was remedied by scattering small fragments of charcoal about the size of peas over the bottom of the muffle, the engine parts being put into the muffle on a tray. The charcoal giving a reducing atmosphere became oxidised instead of the steel, and the trouble was corrected. Explaining what he considered the best types of apparatus for determining the recalescence points, the lecturer said the most accurate results were obtained by the lamp and scale method, using a potentiometer for measuring the E.M.F. from the thermocouple and a chronograph for recording the time intervals. The apparatus might be applied equally to ferrous and non-ferrous metals.

The heating of the specimen was effected by means of a tube furnace of the kind employed at the National Physical Laboratory. It measured only 2½ in. long and 3 in. diameter, the upper portion being heated by an electric current. By means of a slow winding apparatus the specimen was gradually drawn from the cold atmosphere of the base to the top, the rise in temperature being registered every few seconds. At a certain stage the specimen remained stationary in temperature, thus indicating the critical point. Adjustment was effected by the use of a galvanometer, the mirror of which threw a spot of light on the recording scale. The recording chronograph registered the temperature on a moving tape. The necessary time taken was from forty minutes to an hour, and the results were usually very trustworthy.

The Problem of Grey Iron Castings.—II.

By H. J. Young, F.I.C.

(*Continued from page* 501.)

After machining, a good surface is left: this liner develops under service conditions and exhibits the desired wearing properties.

Practical men know only too well the metal they describe as "hard" iron—metal possessing every undesirable property, including weakness and brittleness. It is a matter of engineering interest, therefore, to know that it is possible to make a tough and strong iron which has the correct "wearing hardness," and which has proved its

FIG. 11.—PHOSPHIDE "LAKE" SEPARATING CRYSTALS. MAGNIFIED 250 DIAMETERS.

suitability for cylinder liners, valve liners, piston rings, and so on, under superheat conditions. The "hard" iron, the *bête noire* of foundries and of engineers is a product of ignorance or of misfortune.

Influence of Phosphorus.

Phosphorus in cast iron is the element without which most foundries would close down through inability to run castings with cupola-melted metal. The phosphides solidify later than the mass of the metal, and consequently form segregations in

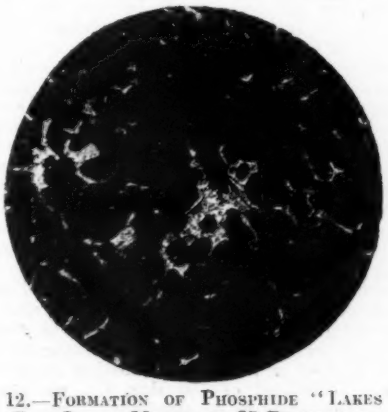


FIG. 12.—FORMATION OF PHOSPHIDE "LAKES" IN CAST IRON. MAGNIFIED 25 DIAMETERS.

between the iron crystals—particularly in large castings where the cooling is slow.

Fig. 11 depicts one of these phosphide segregations as a lake of brittle material separating several of the iron crystals. At a lower magnification in Fig. 12 may be seen how these "lakes" occur throughout the mass; while under other conditions may be seen the absence or presence of a network structure (Figs. 13 and 14).

The phosphorus-content may be kept as low as is found compatible with good foundry results, in heavy work about 0.4 per cent. or 0.5 per cent. In less important or lighter pieces the phosphorus is well kept below 1 per cent., while it should rarely go above 1.30 per cent. in any casting. The rule-of-thumb foundryman is fond of high phosphorus because the engineer likes a good-looking casting, but when the engineer learns to judge other than by the appearance it will be necessary to keep the phosphorus down to some such limits as those suggested above.

In certain compositions the phosphide appears to be expelled from the grains of the metal, and to assemble around those grains in a network similar to, but not the same as, that assumed by

FIG. 13.—BAD PHOSPHIDE NETWORK IN CAST IRON. MAGNIFIED 25 DIAMETERS.

the cementite mentioned above. In weak or poor irons this phosphide is retained more or less within the grains of the metal as seen in Fig. 13, but in a strong iron, perhaps of very similar composition (with the exception of one of two elements) the phosphide is expelled and forms the network shown in Fig. 14. The future understanding of the true causes and effects of this rejection or retention of the phosphide would seem to be a more important matter than has hitherto been anticipated.

Sulphur-Manganese Balance v. Silicon Control.

Irons in which the sulphur-content is not more than balanced by the manganese-content are relatively weak and hard and possess poor foundry properties as compared with irons similar in com-

FIG. 14.—GOOD PHOSPHIDE NETWORK IN CAST IRON. MAGNIFIED 25 DIAMETERS.

position other than that the sulphur is properly balanced. Curiously enough it would appear as if the test of network or no network (Figs. 13 and 14) of the phosphide may be one means of discovering whether the sulphur-manganese balance is swinging in favour of the manganese.

From a tabulation of some thousands of results obtained in actual practice the author has found no exception to the rule that the weak or faulty member of two irons of very similar composition is that one where the sulphur-content is inadequately balanced by the manganese-content.

XUM

From thousands of practical results it is comparatively easy to select a few of very similar composition, save in the sulphur-manganese balance, and to show the effect mentioned above, and Table IV. gives a typical selection of bars with varying sulphur-content and affected only by the amount of manganese balancing the sulphur.

Table IV.—*Showing the Effect of the Manganese-Sulphur Balance on the Transverse Strength of Cast Iron.*

Tranverse Strength.	C.	Si.	P.	S.	M.
2,342	3.43	1.47	0.60	0.231	0.23
3,533	3.47	1.47	0.61	0.220	0.41
2,025	3.39	1.67	1.12	0.176	0.27
3,494	3.40	1.64	1.08	0.172	0.49
2,352	3.37	1.56	1.21	0.137	0.28
3,553	3.35	1.52	1.15	0.132	0.44
1,747	3.45	1.65	1.08	0.122	0.27
3,791	3.41	1.62	1.05	0.129	0.51
2,223	3.40	1.72	1.15	0.110	0.25
3,672	3.38	1.73	1.14	0.112	0.58
3,732	3.37	1.73	1.01	0.116	0.40

It should be clearly understood that the above examples are extremes and that the nearer one gets to the critical point of equilibrium the more difficult does it become, by chemical analysis, to detect any difference between the two irons—but the physical properties remain either very good or very bad right up to each side of the equilibrium.

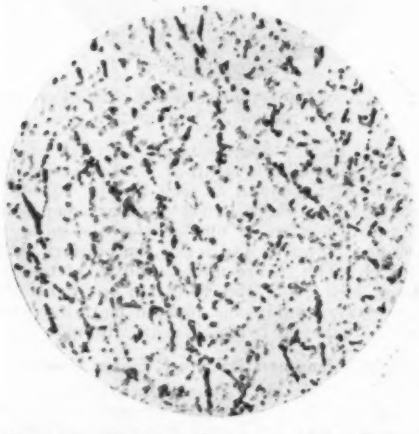


Fig. 15.—Sulphur Print of Cast Iron. Magnified 4 Diameters.

It is possible, even probable, that sulphur and manganese together are the most vital combination of elements in cast iron.

Silicon Control.—Silicon control has assisted iron-founders the world over, but sometimes it fails, and the failure is usually attributed by the foundryman to high sulphur. Overwhelming prejudice has prevented anyone from experimenting practically with high-sulphur metal, but hundreds of tests in ordinary practice have proved to the author that good irons can be made with as much or more sulphur than is contained by other poor irons said to be poor by reason of their sulphur—the real difference being that the good iron has sufficient manganese to balance completely the sulphur, whereas the poor iron has not. The author hopes to pursue this point in another place, and it is of the highest importance that this phenomenon should be thoroughly ventilated and made use of in the future.

Foundries have ever been prone to sudden mysterious spasms of bad metal or bad castings, coming and going as secretly as a disease, and although the management often takes credit for getting away from the trouble it can seldom give any definite explanation of what it has done. In every such case in the author's experience the iron has always suffered from inadequately-balanced sulphur and, what is most important, there has never been any other tangible evidence of the reason for the trouble than that afforded by this wrongly balanced sulphur. The author is well aware that other theories exist and are warmly upheld by their exponents, but he merely offers these practical results and observations as something better on which to work, something impersonal and more scientific, than the many disconcerting theories now existing upon little more evidence than the fact that two irons (of similar composition) are found to give different physical tests, and somebody comes up and says "therefore it must be the pig-iron or the oxygen," but offers no convincing proofs; indeed, usually offers no proofs at all.

For the moment, therefore, we may take it that there does exist a very vital equilibrium point between the sulphur and the manganese, and that this point must be taken into consideration before we can accept any other explanation of the difference between two irons, one on one side of this point and the other on the other side.

Silicon-control is often too weak, and the test-bar is liable to have superior properties and composition to the casting it represents. Moreover, it is sometimes impossible to alter the silicon percentage for fear of harming other properties essential to the making of a good casting. With sulphur-control, low sulphur for one type of work and higher sulphur for another, these difficulties can be overcome and the condition and amount and disposition of the carbon and of the eutectics can be controlled in the casting itself—the *sine quâ non* being that no matter what the quantity of sulphur that of the manganese must be more than sufficient to balance it.

The occurrence of the sulphides in cast iron is extremely interesting. Fig. 15 is a sulphur print (magnified about 4 diameters) of these sulphides. Fig. 16 shows the manganese sulphides as tiny globules, but it is to be remembered that the

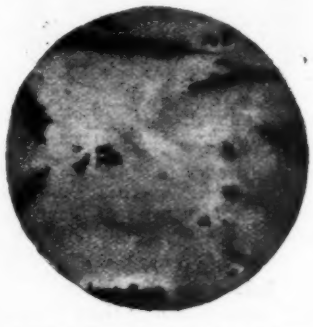


Fig. 16.—Sulphide Globules in Cast Iron. Magnified 100 Diameters.

magnification is 100 diameters and that the globules are infinitely small in the iron itself. Fig. 17 illustrates these same globules photographed at 1,600 diameters.

Turning to internal combustion and to all high-temperature engines, the problem of grey-iron castings is to make them stand up to the work without alteration of strength, form, or surface; to be able to make them alike time and time again; to make them from the cupola alone if possible; and, finally, to make them of such weights and at such prices as will enable our engines to compete in all markets. To-day we are far from any such ideal and barely beginning to aim at it.

When cast iron is drastically heated and cooled several times it begins to "grow," and the graphite enlarges, as shown in Figs. 18 and 19. Assuming that the highest temperature attained by any part of an internal combustion engine is in the neighbourhood of 550 deg. C., we are up against the problem of producing some type of cast iron which will not suffer from insidious deterioration. It would not seem to be a difficult matter to produce such metal, nor would it be, save for the fact that foundry work and cast iron generally has been for so many years a "mystery" controlled by secrets known only to a few, that now supposed we are faced with the problem of having little or no precedent or data or literature of any value in practical work. Hundreds of instances are known where foundries have positively refused to attempt to produce the particular quality of metal asked for—the author knows of five foundries which scoffed at the idea of making an iron which the author makes regularly, they

said it could not be done and was not practicable, and this, probably, because it upset their traditions, or would have done so, if they had made it successfully.

Foundry Ignorance.

To a great extent the engineer has allowed himself to be at the mercy of people who, because they themselves had not done a particular thing or had failed to do it, said that therefore it was impossible; frequently their strongest argument is that it is "not practical," which conveys a hidden imputation to the effect that the man suggesting it does not know what he is talking about, or that he lives in a much less important and easier sphere than the other man.

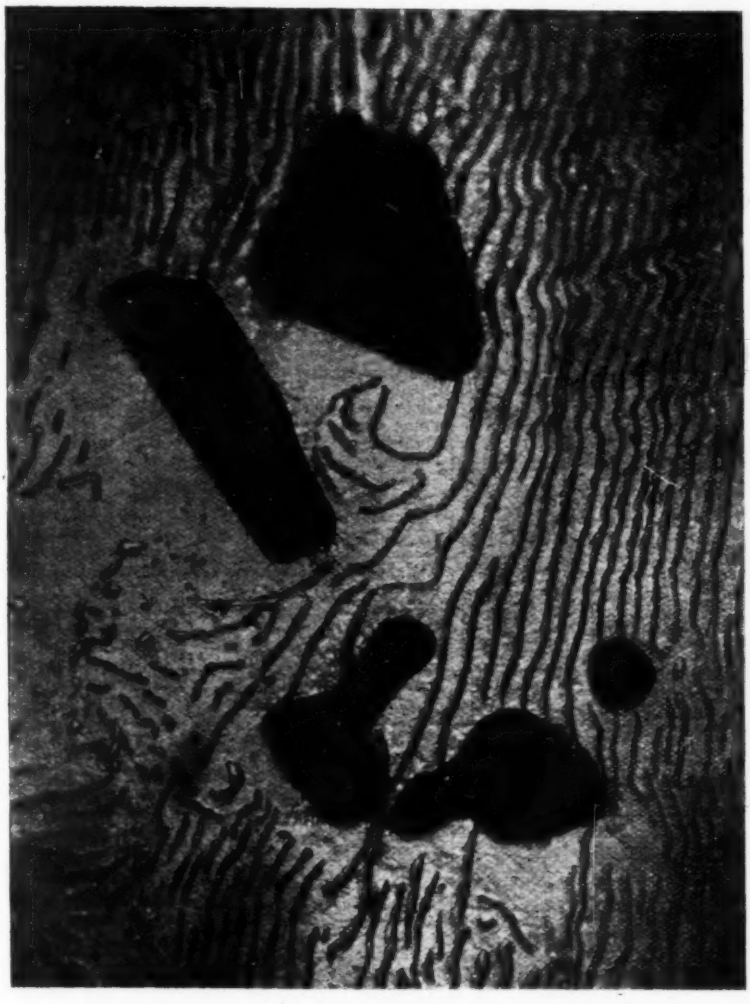


FIG. 17.—SULPHIDE GLOBULES IN CAST IRON, SHOWING ALSO MATRIX OF PEARLITE AND CEMENTITE. MAGNIFIED 1,600 DIAMETERS.

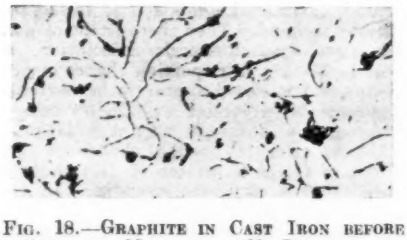


FIG. 18.—GRAPHITE IN CAST IRON BEFORE GROWTH. MAGNIFIED 100 DIAMETERS.

As a matter of fact, the ignorance existing today is remarkable. Large firms are turning out castings which are hardly twice alike as regards quality of metal, and naturally it is impossible for such firms or their clients to make progress or even obtain knowledge as to what they are doing. Specifications relating to cast iron are mere rhetoric, they abound with such phrases as "tough close-grained cast iron of good quality," and since nobody knows what is iron of that quality and nobody can test for it, then, if the castings look all right, everybody is satisfied. This will be disputed, but before entering into any discussion it would be as well to turn to the large propeller casting mentioned earlier in this article and consider whether the "tough close-grained iron of good quality" is in the tips of the blades or half-way up, or in the boss, and apply the same reasoning to every casing containing more than one thickness of metal.

Also we hear of "hard" iron or "soft" iron, and the failure of this or that casting is attributed to the one or the other, irrespective of all knowledge whatsoever and apparently entirely unaware of the fact that extremely good or extremely bad iron may come under either the class termed "hard" or that termed "soft." For instance, if you put "hard" unbalanced-sulphur iron into an important and intricate casting then that casting will be extremely likely to fail, possibly a few

FIG. 19.—GRAPHITE IN SAME CAST IRON AFTER GROWTH. MAGNIFIED 100 DIAMETERS.

minutes after the metal enters the mould, and, in any case, the metal will be poor and brittle and have bad machining properties. On the other hand, the same "hard" iron with the sulphur properly balanced would be extremely likely to give the desired qualities of hardness and toughness, and to cast well in the foundry.

Condition of the Internal Combustion Engine Trade.

The author has been able to survey several specimens of cast iron made by well-known makers of internal combustion engines, and in no case had the castings a standard composition, nor had they an average standard composition. Also it may be clearly stated that no particular attempt at producing anything other than ordinary machinery iron could be detected.

Table VI. shows some of the irons from one engine, and it does not take a metallurgist to see that no two are alike, and that the names "cylinder" or "liner" or "piston" are mere names, and point to no particular quality of metal; indeed, the liner metal is sometimes of cylinder quality and, at other times, the cylinder metal is of liner quality, while the piston metal fluctuates in between.

All the above are supposed to represent the highest possible class of special material for special purposes—in reality they are similar to the ordinary rule-of-thumb products.

In Table VII. are given the composition of the "special" iron from another equally well-known maker of internal combustion engines, and once again is the material of a nondescript and varying character.

Therefore these people have not only made no advance in the quality of their material, but they have not as yet succeeded in controlling their work so as to produce any one quality more than once.

Recently a representative came to the author offering high-priced low-carbon pig-iron "specially suitable for Diesel work." After looking at his iron and the composition of it, the author asked him: "Why is this material specially suitable for Diesel work?" The man was quite at a loss and possessed not one fact or figure upon which to base his claim, and in after conversation he assured the author that his iron was selling extremely well and that never before had he been asked why it was specially suitable for Diesel work, and that, moreover, he did not know.

In order to be able to raise the working temperatures and pressures of engines or to lighten their structures it will be necessary to know more about cast-iron than is known to-day. The chemist himself knows very little about it, but he is in a good position to find out. If this country can get a number of chemists working upon these lines in different works then the volume of information will become greater and wider and progress will become apparent.

The foundryman has, as a whole, already accepted the chemist, and the fact is very greatly to his credit. The engineer, however, has got to do more than accept the chemist, for he will, in the future, need to accept a certain amount of chemistry. Our big educational institutions, many of them training young engineers, teach little or nothing about cast iron and the metals of commercial engineering, and the result is, that these young men go into the works or into the drawing offices of the works without any mental picture or any conception whatsoever of the behaviour and constitution of metals. The foundrymen, many of whom are eager to learn, have nowhere to go to get knowledge, or, at any rate, knowledge of the type that they can assimilate and that will be valuable to them.

The whole system needs overhauling, and the engineer is the only one sufficiently powerful to bring about that overhaul—let him demand more instruction and more knowledge and the supply will speedily be to hand. Then there is the case of the British Cast Iron Research Association, which needs to be given a fair sporting chance of proving its worth, and it would appear to be obvious that everybody making, buying, selling or using castings has got a stake in this Association, and should look after it on the chance of getting value out of it—as a matter of fact there is no "chance" but a certainty *providing the Association receives proper support.*

In presenting this survey of practical work and of observations made under works conditions, the author has aimed at one thing only, namely, to arouse interest in that most fascinating and useful of metals, cast iron, and in its great possibilities.

In conclusion, the author expresses his thanks to Mr. Summers Hunter of the North-Eastern Marine Engineering Company, Limited, for the facilities which have been afforded him, and to Mr. C. Gresty for help given in the preparation of the micrographs and slides.

TABLE VI.—*Showing the Variations in the Composition of Internal Combustion Engines Cylinders, Liners, and Pistons.*

Description.	Silicon.	Other Elements.
	Per cent.	
Cylinder	1.42	Combined Carbon varies between 0.26 and 0.59 per cent.
Another	1.54	Free Carbon " " 2.74 and 3.22 "
Another	1.56	Total Carbon " " 3.29 and 3.54 "
Another	1.59	Phosphorus " " 0.26 and 0.61 "
Another	1.79	Sulphur " " 0.083 and 1.013 "
Another	1.85	Manganese " " 0.50 and 0.66 "
Another	2.11	Transverse Strength " " 2,480 and 3,140 lbs.
Another	2.12	Tensile Strength " " 8.9 and 13.5 tons.
Liner	1.03	Combined Carbon varies between 0.56 and 0.80 per cent.
Another	1.55	Free Carbon " " 2.61 and 2.95 "
Another	1.59	Total Carbon " " 3.30 and 3.58 "
Another	1.64	Phosphorus " " 0.30 and 0.61 "
Another	1.71	Sulphur " " 0.077 and 0.100 "
Another	1.75	Manganese " " 0.53 and 0.90 "
Another	1.76	Transverse Strength " " 2,280 and 3,024 lbs.
Another	2.16	Tensile Strength " " 10.2 and 14.9 tons.
Piston	1.35	Combined Carbon varies between 0.60 and 0.72 per cent.
Another	1.57	Free Carbon " " 2.69 and 2.78 "
Another	2.12	Total Carbon " " 3.38 and 3.41 "
		Phosphorus " " 0.30 and 0.61 "
		Sulphur " " 0,078 and 0.097 "
		Manganese " " 0.64 and 0.81 "
		Transverse Strength " " 2,480 and 3,140 lbs.
		Tensile Strength " " 1.21 and 14.4 tons.

TABLE VII.—*Shows similar conditions to those existing in Table V., but of another make.*

Description.	Silicon.	Other Elements.
	Per cent.	
Cylinder	1.00	Combined Carbon varies between 0.85 and 1.06 per cent.
Another	1.21	Free Carbon " " 2.18 and 2.55 "
Another	1.30	Total Carbon " " 3.24 and 3.40 "
Another	1.43	Phosphorous " " 0.67 and 1.06 "
—	—	Sulphur " " 0.059 and 0.100 "
		Manganese " " 0.60 and 1.28 "

XUM

Design, Equipment, and Organisation of a Modern Foundry.

By Jas. E. Wilson.

The object of this article is to deal with the foundry on the most modern lines; not only considering the product in itself, but the manner of its production, the well-being of its producers, and the positon it will hold in the balance-sheet of the company whose capital is invested in it.

Size of Foundry.

In order to have some definite object in view with regard to size, it is supposed a commission has been received to lay out new foundry premises for a firm who are producing either engines or machines of a more or less standardised nature, and whose demands for iron castings would reach from 40 tons to 60 tons or over per week.

On this assumption, the writer presents a general design of building and a model scheme of organisation which can be modified, or enlarged, or even improved upon to suit the requirements of any founder doing a similar class of business.

The Plan of Building.

The design is such that it becomes a complete and self-contained unit, which may be turned about from east to west, or north to south, to suit the arrangements of any existing buildings.

The building would require a site of about 37 yards by 57 yards. This ground would also provide ample yard space for storage of materials and boxyard.

By reference to Fig. 1, the building is shown to be composed of steel framework and filled in with brickwork and of sufficient strength to meet the architectural requirements.

The main bay of the building would be 150 ft. long by 50 ft. wide, and a second bay 150 ft. long by 20 ft. wide. This smaller bay would accommodate sand and coke stores, blower-house, drying stoves, cupolas, brass and core shops.

The roofs of both bays should be 26 ft. from floor to principal, and would be provided with louvre ventilators, and for about two-thirds of roof area would be glazed with wire reinforced glass. Top light is essential for foundry work, but side windows should, in some part, be used according to necessity. The natural daylight would serve most purposes and would obviate expense in artificial light.

The approaches to the works should be provided with railway track, which could be linked up with any existing railway line, and would serve either for materials coming into the yard, or for the dispatch of goods. This line should pass around one end and side of the site, and by the provision of turntables could enter the main bay.

In addition to the 4 ft. 9 in. gauge a 2-ft. gauge light railway service should run around, and by means of turntables serve the whole of the yard and enter the main building at one side, and at the main entrance a double line would be provided by the insertion of two rails, making 2 ft. gauge with the outer or 4 ft. 9 in. rails. This double line system would serve for light or heavy traffic. The light rail service, having a number of standard bogies of 2 ft. 6 in. width, could pass up and down the shop and around the yard without interfering with the heavy traffic to any great extent, and would thus largely eliminate the wheelbarrow.

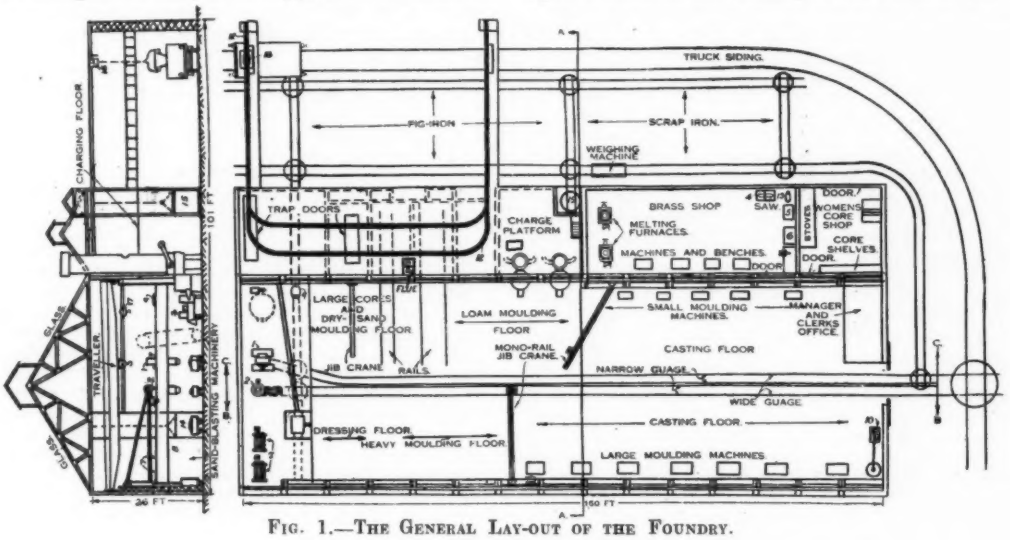


FIG. 1.—THE GENERAL LAY-OUT OF THE FOUNDRY.

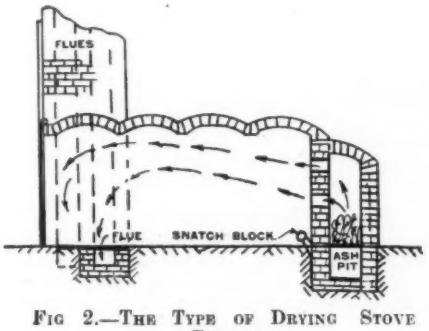


FIG 2.—THE TYPE OF DRYING STOVE PROPOSED.

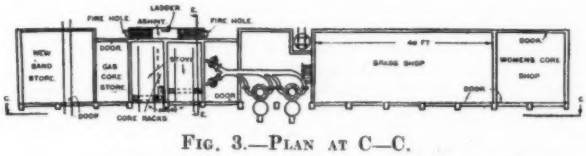


FIG. 3.—PLAN AT C—C.

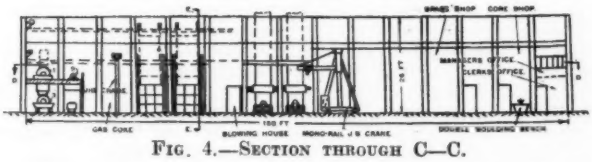


FIG. 4.—SECTION THROUGH C—C.

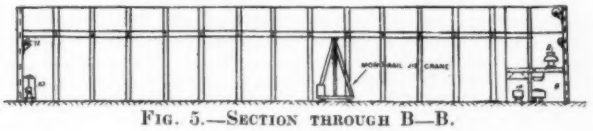


FIG. 5.—SECTION THROUGH B—B.

Organisation.

At the end of the main bay a platform of reinforced concrete would be erected. The top side of the floor would be 9 ft. and underside 8 ft. from ground line. This platform, forming the sand preparation department, should be fitted up with suitable machines for that purpose. This part of the work would be taken entirely out of the moulder's hands, leaving him more time and energy to devote to more skilled work.

Supposing a man's floor to be cast up and ready for knocking out, the operation would begin thus: First, a labourer (not a machine operator) would clear all the flasks and floor of any loose scrap from pouring; two more labourers, having brought up a light rail bogie to the front of floor, would proceed to sling the flasks (with the sand and castings still in them) on the nearest mono-rail jib crane and place them on the bogie. When the load is sufficient they would run the flasks towards the sand platform where, by using the turntable, they would send them up the lift to the platform level; here, two more labourers would run out the bogie, and by means of the hoist on overhead transport rail would proceed to knock out the flasks, the sand, dry and hot, falling to the floor in a heap, the castings taken to the other end of platform, and flasks returned down the lift to the moulder. The black sand would then be sprinkled with water by a hosepipe with a rose end and any necessary new sand added.

On this floor would be installed a disintegrator mill, shown in Fig. 1, of the Hall's "Invincible" or similar type, fitted with loose reels and roller bearings. This machine, of the 24-in. size, deals with 3 tons per hour of black sand, using about 6 to 8 b.h.p. for driving.

The two men would then put the heap of sand through the hopper of the mill without any further effort on their part than the shovelling of the sand to the hopper. The revolving reels disintegrate the hard sand and thoroughly mix it, that it would once more be ready for the moulder. It will be observed that a hopper is placed underneath the mill, attached to bottom side of the platform. This hopper would hold about one bogie load of sand, and by means of a slide arrangement the whole of the sand would be allowed to drop into a bogie placed there for the purpose; this bogie of sand could then be returned to the moulder. By this method of sand mixing the moulding floor would be cleared from time to time, enabling the moulder to place down on the same ground not only one but three or four moulds, thus allowing of any economy in space, labour, and time. These remarks so far only apply to the machine moulding and light work section on either side of the bay.

For the larger and heavier class of moulds the overhead traveller would be used to strip the box parts from the castings at a suitable position, and afterwards remove them to the dressing department and the box parts to moulders' floor. The sand would then be cleared of all gaggers, grates, or any other irons, and then sprinkled with the hose, after which it would be loaded into a bogie and sent to the mill by means of the lift, where it would be dealt with in the same manner as before.

Should there be a large amount of heavy work to be dealt with, an alternative method would be to fix a bucket conveyor, which would operate from ground floor to overhead of the hopper of mill, indicated in Fig. 1, Ref. 1. Sand then would be picked up by buckets at bottom and dropped on the top into the mill and deposited into bogies as before.

Facing sand would be dealt with in the following manner: A bogie load of new sand would be brought from the sand store by means of the lift and spread on the floor. Old sand in the proper proportion, coal dust, and any other ingredients would then be added, and the whole shovelled in the hopper of a Herbert Duplex mixer, Fig. 1, Ref. 2, which, by a circular horizontal movement, would deal with about 3 tons per hour of sand, which, after the operation, would be so finely mixed that it would be ready for immediate use, only requiring a fine sieve to cover the patterns. The facing sand would be dropped through a grating in the floor, and passing through the hopper would be transported by bogie to the moulders' floor. Ground sand and loam would be prepared in an ordinary pug-mill on the ground floor. This mill would have a pan of about 6 ft. diameter with one cogged and one plain roller, and would be self-delivering.

The Dressing Shop.

On the same platform where the sand would be prepared, there would be two rattlers, shown in Fig. 1, Ref. 7, of the ordinary type, which would take care of all the castings as they would be knocked out of the flasks. When taken out of the rattlers, the castings would descend in bogie loads to the floor beneath to be further dealt with. Under the platform, on the rattler side, the sand-blast chamber should be installed for dealing with the larger pieces. In order to deal with the small and delicate castings there should be a revolving machine, where, by slow movements of the drum, all faces of the castings could be blasted automatically. A double-disc emery grinder would do all the grinding.

On this floor the larger castings would be dressed, for which there would be installed pneumatic hammers, a flexible shaft, portable grinder, and the usual benches with vices, etc.

Drying Stoves.

Two stoves are shown, built on the same side as the cupolas. Both stoves would be of similar size inside, but one, having both flues built inside, would necessarily have a narrower doorway, and the space behind the flues would be used for core-shelves.

The length shown from door to fire chamber in both cases is 17 ft., and the width, in main part, 9 ft., with one doorway 5 ft. wide and the other 7 ft. 6 in. wide. Both would be fitted with bogie track with two snatch blocks fixed in the floor, one at the fire end of stove and the other at the opposite end of track, so that by means of chain and crane the loaded bogies could be moved easily in or out, no pinchbars being necessary. By reference to Fig. 2, a general idea of design can be obtained.

The principle of the firebox is that of a gas generating chamber. The gas, passing through apertures in the wall, as shown, combustion is obtained by the air being drawn through the fire-bars by the circulation caused by the flues. When the door is closed there is no outlet for the hot air except by passing through the grating in the floor, as indicated in section, so by this means the stove is equally heated.

The door is made of steel framing and fitted with asbestos sheet in the panels. It is also provided with a sand seal at the top. This design of stove is very serviceable and economical in fuel. About 2 cwts. of common gas coke will effectually dry the stove full of work in one night.

The larger cores, dry sand, and loam-moulding would be carried on adjacent to stoves.

Iron Melting Arrangements.

In Figs. 1 and 3 two cupolas of the drop-bottom and receiver type, having a capacity of from 3 to 4 tons per hour, are shown side by side in the centre of the foundry. The dimensions are of the usual design, as given by the Alldays & Onions Company, or other established make. Exception to their general design is made in the drawing by carrying the top part higher to suit the building, and a spark arrester is shown, which in most cases is advisable. The air inlet elbows are also placed nearly in the horizontal plane instead of in the vertical, as in the original design.

Referring to Fig. 3, it will be noticed the blast supply pipes are carried at the back of the airbelt, and they should be raised to an angle to permit of free access to the peepholes. The pipes then would be more out of danger and would give a more direct line of blast pipe, thus reducing pipe friction. It also would allow a good sweep at bends from main to belt elbows.

The blowing arrangements shown are somewhat new. In the drawing two Keith-Blackman self-driven electric fans are shown. Either of these would be of sufficient power to serve one cupola. The method adopted to join up to the main pipe would allow of two advantages, namely, should either of the fans go out of order, a few minutes of melting time only is lost, as by shutting one valve at the fan outlet and opening the other the process could re-commence immediately; also when two cupolas were required there would be two fans,

and as each should be fitted with its own starting arrangements, the furnaces could be worked independently by the opening and shutting of the valves at the elbows.

The charging arrangements would be as follows: Pig-iron and scrap would be located at convenient distances in the yard, the different brands being kept in separate piles.

Each charge, say of 10 cwts., would be weighed off in its proper proportions at the weighing machine, which should be placed near the cupola lift; the charges would be sent up to the charging floor and placed in rotation in the order as required, if special metal were being run. As each bogie is emptied into the furnace, it would be sent down the lift again. These bogies, of standard size, are mounted on rails, can be run anywhere in the yard, as the bottom of lift is fitted with a turntable. Space has been allowed for about 6 or 7 of these bogies to be on the top at one time, therefore the charges would be only handled once from the man below to the charger at furnace door. Coke would be weighed in baskets or skips averaging 28 lbs. to 32 lbs. each and loaded on bogies in the coke store adjoining.

If strong irons are to be used a mechanical pig breaker should be fitted, which could be operated either by electric or pneumatic power.

In Fig. 1, Ref. 12, an overhead runway rail is shown, supported at two ends by lattic work steel columns and at the part under the roof being special supports. It would be shaped like a letter "U," having two lines and two switches at the bottom. The runway would be fitted with a Herbert Morris block of the Q.E.F. type, and have a special contrivance for easily opening the switches.

Provision for the storage of cupola coke is made on the floor covering the stoves. The same floor covers the gas coke and sand sheds. To unload a truck of cupola coke the truck would be shunted to the nearest column. Immediately overhead hangs the hoisting block, from which a special conveying bucket with a hinged bottom and a special catch would be suspended. The bucket would be lowered near enough to be filled, and having been filled would be hoisted sufficiently high to clear all obstacles. The bucket would then run along the runway line by being pushed from behind until in position for dropping the load. Then by pulling a catch the bottom would open and the coke would be dumped in any position under the runway. Sand and gas coke would be dumped in a similar manner through trapdoors in the floor opening into the respective sheds.

A special footway is provided for the man following the bucket.

Arrangements for Moulding.

The amount of core making, dry sand and loam moulding being indefinite, it might be that more room for moulding would have to be made, and perhaps another unit to the drying arrangements would be necessary, which would mean some alteration of plan. This might be obviated largely by drying some of the work *in situ* by means of one of the many portable drying stoves which are quite suited to such work.

Repetition work would constitute about two-thirds of the whole total output. No standardised casting should be moulded by hand if at all possible to adapt to machines. These can be called the heavy type of machine-moulded castings, and would call for a heavy type of moulding machine, which requirement would be met by the installation of a large size Ajax turnover jarring pneumatic machine. Such a machine could deal with box parts over 6 ft. square, and might be used for any pattern of 16 in. draw, and therefore would be suitable for such things as engine beds, etc. Another class of machine, but equally useful, would be one of the Tabor machines which jar, ram, roll-over, and draw the pattern of a mould up to about 5 tons in weight with about 100 lbs. per sq. in. pressure of air.

A large quantity of medium weight patterns of various shapes could be dealt with by the introduction of several useful types of machines, each of which would have its own particular value for some of the work. Messrs. John Macdonald make a very useful machine of the medium size which will ram, turnover, and draw pattern in box parts about 2 ft. square. Messrs. Macnab & Company also have a very useful portable type of roll-over machine which can travel along the length of the floor and thus save carrying the moulds any distance. These two classes could be adopted.

Many patterns could be delivered from the mould by the simple flask-raising device, or stripping-plate method, and for these there is a good choice in the "Wardle" machine, made by the Britannia Company, of Coventry. Of these, several of the Nos. 1 and 2 would be installed, No. 2 having a draw of 15 in. The same makers supply a good small turnover machine. Nos. 1 and 2 turnover machine could deal with most of the smaller work requiring to be turned over. A number of these would be installed.

Assuming there were a lot of jobs that would be made better on a hand-ramming machine owing to some peculiarity in the patterns, a few of the "Adaptable" make would be put in, as these might easily be adapted to a variety of jobbing work when only a few castings might be required, or kept continuously on special patterns.

The heavier work would be kept on one side of the bay and the lighter on the side near the cupolas. These machines would be served by several electric travelling and hoisting mono-rail jib cranes, which might be fitted to extend as far as the nearest light railway, and could be arranged to have either swing or fixed jibs, and by travelling along by motor they could cover the ground quickly and would take up little floor room. The spaces between the columns supporting the overhead gantry could be utilised for cupboards, lockers, and pattern shelves. The traverse of the hoisting blocks would be by hand. Only one of these cranes is shown on each side, but in a length of some 135 ft. three might be required, as during part of the time pouring operations and knocking out of flasks would keep one going. On the light side of the shop one might be sufficient, as most of the work would be of the light order. This one, however, should be able to swivel around in order to deal with the metal from either cupola spout, and as the jibs on either side would just pass each other, metal could be changed easily from one side to the other. The main of the heavy lifting would be done by the overhead traveller, which would be of a capacity to suit the work.

If the large traveller got out of order, or would be otherwise engaged, the jib on the cupola's side could pass metal over to the other jibs; thus the work could go on for some considerable time.

Brass Department.

Such a works is sure to require a fair amount of complementary non-ferrous work, provision for a brass department is made, which is self-contained, and would be a part of the 20-ft. long bay building. In this, two furnaces of the Morgan or Wright type would be installed. In the plan, two tilting coke furnaces of about 200 lbs. capacity are shown. In the illustration they are shown with an electric fan of the Blackman type affixed to the standard, but might be used with any blast supply.

In addition a blast crucible furnace of about 100 lbs. capacity would be fixed which would be used for experimental melting. As an alternative to coke furnaces a similar tilting furnace could be installed to melt with blast in the shape of compressed air and common creosote or petroleum oil or gas.

As most of the castings would be of a standard nature, the usual course would be followed of mounting every possible pattern on machine plates. For the moulding at least one Britannia turnover type machine of a size suitable to take the largest patterns would be installed.

For the probability of a number of patterns which might require special hand-ramming at least one machine of the "Adaptable" type, which is well designed to deal with almost everything within its size, should be installed.

For odd jobbing work and plate-moulding the double bench, shown in Fig. 4, which accommodates one man on either side, should prove useful. This forms not only a bench but also a bin, which holds the moulding sand and catches the surplus sand when struck off the tops of flasks, thus keeping the moulder and his floor space free from sand.

The dressing of castings would be reduced to a minimum by the following methods: A band saw, (Ref. 4), Fig. 1, of ordinary type, but suitable

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for metal sawing, would be fixed, and all runners or risers would be cut off by this means. This method of sawing supersedes the ordinary git cutter, as it can deal with almost any shape of casting or size of runner, and at the same time cut nearer to the casting, leaving very little to trim off by the grinder. The bandsaw has proved efficient for all metals and most economical in time and power.

The castings would then be placed in a rattler, shown in Fig. 1, Ref. 5, of the ordinary kind, except that the barrel would be perforated and would revolve in a water tank. The water washes off all sand and the castings come out clean. Any surplus edges then would be ground off at the emery wheel, shown in Fig. 1, Ref. 6, which would have two disc wheels of different diameters, and provided at one end of the disc shaft with a revolving wire brush.

All of these machines are driven by motor and overhead shaft at the end of the shop. This system would leave very little hand work to be done, and therefore only small bench and vice accommodation would be provided.

Core-Making.

Core-making has now been much standardised, and made into a clean and orderly occupation, and can be efficiently conducted by female labour. It is thus desirable to keep the core-making department separate. This department, therefore, would be self-contained in a convenient corner, which at the same time would form part of the main establishment and be immediately under the eye of the management.

Reference to Fig. 1 shows a shop of about 20 ft. by 20 ft. provided with one door leading to main bay and another for the use of the women only.

Benches of the double type would be fixed on one side so that workers would face each other. In no case would workers stand with their faces to the wall, because where the benches run along the wall the work would be more or less in the naturally darkest position and a charge hand could not adequately supervise the work. A useful jar-ramming core machine of the Mumford or similar type would deal with a large quantity of cores of the larger sizes, to suit which machine the core boxes would be specially made. Standard cores could be produced in stock lengths by a "sausage" machine. The blacking of cores need not be done by hand and brush, but by spraying by means of compressed air.

Core drying would be done in a gas or coke-fired stove, built in three units, each a separate chamber but forming one complete stove. Each stove would be fitted with draw-out trays or racks sliding on ledges running on each side so that any rack could be taken out, emptied, and re-filled without interfering with the others. Pyrometers are necessary for registering the temperature. The dried cores would be removed to shelves, which would act as core store and would itself be slightly heated to avoid cores getting damp. Messrs. Wright make a very efficient gas stove, which has the advantage of regulation of temperature.

Heavy cores requiring skill to make would be made by men near the large stoves.

Box-part Yard.—If a standardised set of box parts is in constant use, only a small space would be needed for box parts outside, and sufficient room for these might be found adjacent to the rails where they could be handled by the travelling jib crane.

Motive Power.

Arrangements would be made to drive all the machinery by electricity and compressed air. The moulding machines would be served by an air compressor (Ref. 10, Fig. 1) shown inside the building so that the pipe lines might be as short as possible and thus reduce frictional losses.

The type of compressor recommended is shown in Fig. 1, and is of the Broom & Wade make. By fixing the compressor at the position shown a separate building can be given it by enclosing it on two sides, or as an alternative, it would be placed as an annexe on the outer side of the same wall.

The motor (Ref. 11, Fig. 1) for driving the compressor is shown on the wall overhead and drives direct on the pulley. Overhead drives would be confined to two shafts only One of these would run from side to side on the gable-end wall, where the sand-preparation department would be provided. This shaft would drive the pugmill on the ground floor by passing the belt through the platform. The two sand mixers would be driven by countershaft as indicated, and the two rattlers direct from the main shaft. The belt necessary for the revolving sand-blast apparatus (Fig. 1, Ref. 8) also would be carried through platform. A 25-h.p. motor (Fig. 1, Ref. 9) would be fixed on the platform as shown.

The second shaft would be placed in the brass shop on the end wall, and would drive direct to each machine, having an 8-h.p. motor (see Fig. 1, Ref. 13) placed as shown.

Hoisting Arrangements.

A travelling crane of sufficient lifting power would serve any part of the main floor except the sand platform end, where no lifting would be required. The mono-rail jib cranes would serve any part of the sides except the part where the stoves would intersect the wall. A fixed jib could be placed on the wall to cover the core-makers' ground and to serve to load up the stove bogie.

The sand lift (Fig. 1, Ref. 14) and also the cupola lift (Fig. 1, Ref. 15) are shown operated by electricity, and have automatic control arrangements. The only hand-operated hoists are the travelling blocks on the sand platform (Fig. 1, Ref. 17) and the outside runway (Fig. 1, Ref. 16).

Alternatives in Design.—If the brass department were not required, this part of the building might be turned into the dressing shop or used for light moulding work.

The sand conveying system might be arranged by the belt and bucket method, but for a building of this size, in the opinion of the writer, would prove more costly in operation and would take up a lot of valuable space

The Determination of Manganese in Brass.

Dissolve two or three grams of the metal in 60 ccs. HNO_3 (S.G. 1.2). Evaporate to about 15 ccs. and add 50 ccs. HNO_3 (S.G. 1. 42) and 3 grams of $KClO_3$. Boil for 15 minutes, remove from the source of heat, and add a further quantity of 50 ccs. HNO_3 (S.G. 1.42) and 3 grams $KClO_3$. Boil for 15 minutes, cool quickly by immersing the beaker in cold water and filter. Wash the precipitate of MnO_2 free from acid with hot water and place the filter paper and precipitate in a conical flask containing a solution of 0.285 grams of $FeAmSO_4$. Cork up the flask and shake the solution until the paper is pulped and the precipitate completely dissolved. Titrate with $K_2Mn_2O_8$. solution containing 1.149 grams $K_2Mn_2O_8$. per litre.

1 cc. $K_2Mn_2O_8$ = 0.001 gram Mn.

20 ccs. $K_2Mn_2O_8$ = $FeAmSO_4$.

—F. A. L.

The Formation of Pearlite in Steel.—In a Paper on this subject, recently read before the Cleveland Institution of Engineers, Mr. J. H. Whiteley showed that pearlite can grow directly from a solid solution of carbide of iron in gamma iron without the formation of any intermediate stages, and that the so-called transition stages, troostite and sorbite, should be regarded as alternative or side products of the transition. He gave evidences of "lag," showing that a certain degree of supersaturation is required before pearlite will form, and that growth never starts within the area, but at the boundary, apparently through inoculation by the adjacent ferrite or cementite, as the case may be. The average coarseness of the pearlite was not found to depend either upon the length of heating or T max., but simply upon the rate of cooling through Ar1. This was explained as due to the greater opportunity allowed, in slow cooling, for solution and diffusion of the carbide to occur whereby the spacings are widened. The maximum width of ferrite laminæ yet seen in slowly cooled hypo-eutectoid steel is 1/22,000-in. With a given rate of cooling, the presence of manganese and silicon in steel increases the fineness of the pearlite, and pearlite formed in the presence of free cementite is much coarser than that formed either in eutectoid or hypo-eutectoid steels. Apparently this effect is due to the manner of inoculation.

A New Pig-Breaking Machine.

It is an open question whether pig-iron should be broken before despatch or after receipt, but in either case it should be conducted economically. When manually accomplished, the work is laborious, and is a type of job on which much money can be wasted.

Patents of a new type of pig-iron breaker have recently been granted to Messrs. E. Roper & Company, of 71, North Street, Keighley, who are themselves marketing the machines illustrated below.

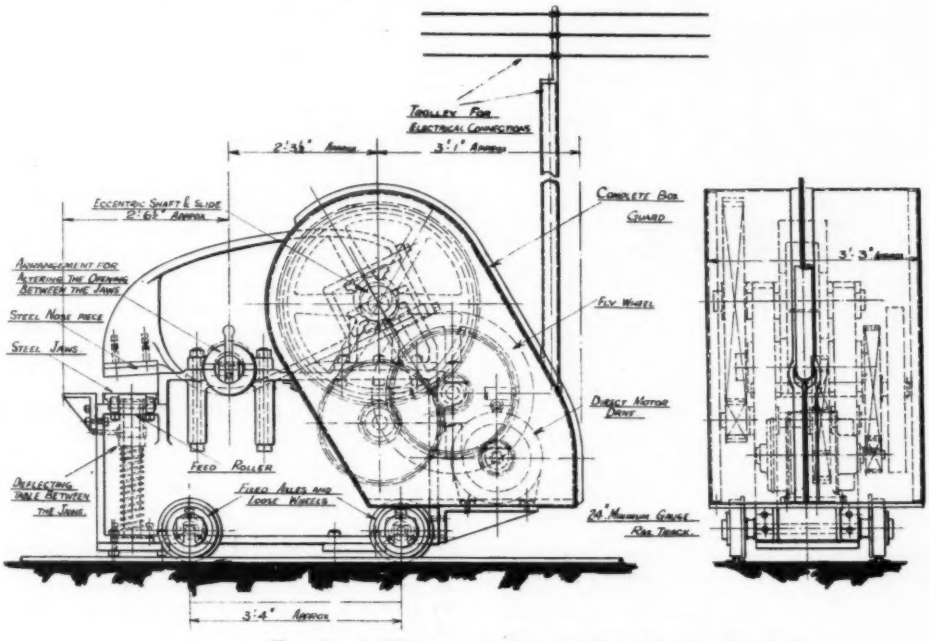


FIG. 1.—A MOUNTED SINGLE-JAW PIG-BREAKING MACHINE.

These machines are made either for belt or direct motor drive, the motor-driven machines being arranged for mounting on any gauge rail track if desired. For the track machines, the electrical connections are made by means of a trolley to overhead wires, similar to a travelling crane.

Fig. 1 illustrates a mounted single-jaw machine, with direct motor drive. The motor is fixed at

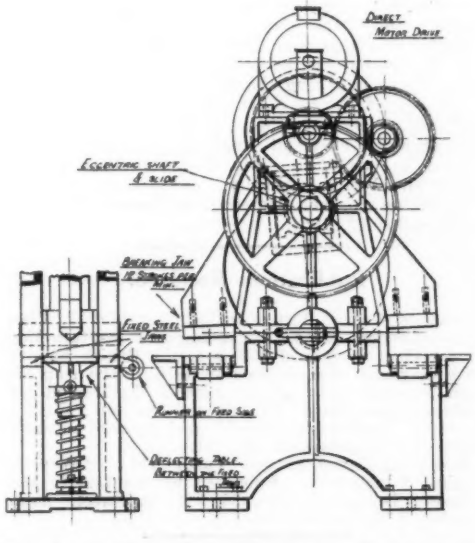


FIG. 2.—A STATIONARY DOUBLE-JAW PIG-BREAKING MACHINE.

the back of the machine and geared to the eccentric shaft, which operates the breaking beam by a double train of wheels, one shaft being fitted with a fly-wheel to equalise the drive. The whole of the gearing is enclosed in a steel box guard, made in halves, which gives adequate protection when worked out in the open yard.

Fig. 2 shows the double-jawed machine, geared in the same manner but with the motor mounted at the top of the machine. This machine can also be mounted on a track and fitted with a box guard and trolley in the same way as the one illustrated in Fig. 1. With this machine a double output is secured with a comparative small increase in the power consumed and first cost.

With the single-jawed machine running at 12 strokes per min. one man can easily break one ton of pig-iron in ten minutes, and with two men in five minutes in the double-jawed machine, the machine being capable of doing twice this amount if extra men are employed.

This capacity holds good for the breaking of the usual percentage of pig-iron and sows of ordinary, hematite or cold-blast iron.

Improved Features.—The machines illustrated are fitted with a simple arrangement for altering the jaw opening. This is an important feature when the great difference in depth of the pigs to be broken is considered. It obviates having to pack up thin pigs for breaking them, and does away with the growing pile of thick sows which will not enter many machines.

The fronts of the machines are open, which enables a short piece of sow to be put in at the front centrally on the jaws instead of over the feeding roller, and also does not limit the width of an irregular piece of pig which can be put through the machine.

Pig-iron breaking machines are a considerable saving where a substantial amount of iron is dealt with daily, both in the labour involved and time occupied. The pig is broken into shorter pieces, giving better conditions in the furnace when charged.

Many founders overlook, when considering their installation that when the pig is raised on to a feed roller it has only to slide through, hence while the machine is breaking it in three or four pieces the man is practically resting ready for handling another piece, enabling the effort to be sustained.

"BLADE LEAKAGE IN STEAM TURBINES" was the subject of a Paper read by Dr. J. Morrow at a recent meeting of the Applied Science Section of the University of Durham Philosophical Society at Armstrong College, Newcastle.

THE LONDON AND SOUTH-WESTERN RAILWAY COMPANY has made a definite offer to the Government for the world's largest floating dock, which at present lies at Hamburg, and has to be surrendered by Germany as punishment for the treacherous sinking of the German Fleet at Scapa Flow.

XUM

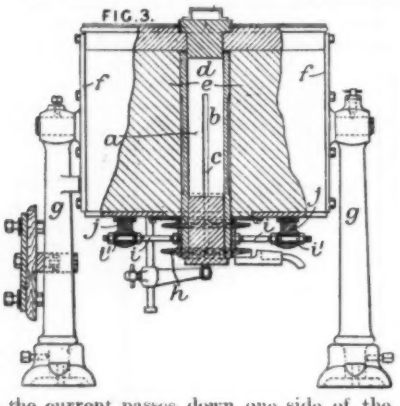
Patent Specification Abridgments.

Particulars of Complete Specifications accepted compiled by Mr. Eric Potter, Patent Agent, 27, Chancery Lane, W.C.2, and Albert Street, Nottingham.

169,756. Morgan Crucible Company, Limited, and Payne, G. I., Battersea Works, Battersea, London. Electric Furnaces. June 2, 1920. No. 14,998.

An electrically heated tube, slab, muffle, crucible, trough, or like container is divided in halves along a line extending from one end, at which the terminals are fixed, to a point near the other end so

FIG.3.



that the current passes down one side of the container and up the other. In the form shown, a cylindrical body is divided into two parts *a*, *b* by a slot *c* which extends from one end to near the other, which forms a bridge-piece *d* connecting the parts. Terminals *h* are held by rods *i* against the parts *a b*, insulating sleeves *i*¹ separating the rods from their brackets *j*. The body is mounted in a fire-clay lining *e* contained in a metal jacket *f* mounted in bearings on the standard *g*. The body may be divided by three slots for use with three-phase current. A crucible may be similarly slotted, the slots being filled with a refractory material of high resistance.

169,786. Dumont, P., Ampsin, Liège, Belgium. Furnaces. June 30, 1920. No. 17,855.

A shaft furnace, particularly for the calcination of lime, is provided with grids at different levels to prevent the superposed mass from crushing the lower mass, and with a system of flues whereby the combustion products are withdrawn uniformly around the circumference of the shaft, and also with means for uniformly distributing the air supply whereby cooling of the charge is effected before passing through the discharge hoppers. The grids 17, 3 are constructed of I-beams 4, 6 arranged

FIG.8.

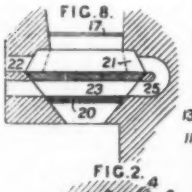


FIG.2.

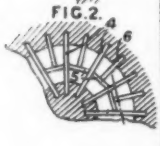
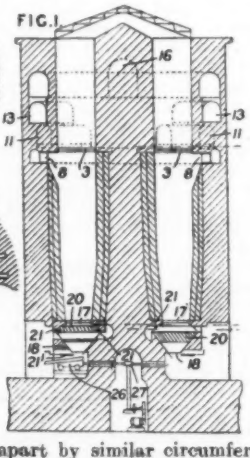


FIG.1.



radially and spaced apart by similar circumferentially-arranged beams 5, each beam being covered with an inverted channel iron to prevent lodging of the descending mass. The grids are arranged immediately above the air-supply passages 23 and the outlet flues 8. Six discharge hoppers 18 are circumferentially arranged, the hoppers being wide at their tops to form spaces 21 into which air is fed through passages 22 and through the passages 23 formed in triangular-sectioned bars 20 which divide and support the descending mass. Passages 25 connect the passages 23 and the spaces 21. A discharge gate 21¹ is provided and oscillating shoots 26, operated by a common eccentric 27, transfer the material to conveyors. Eight exit flues 8 are connected in pairs to four flues 11, which are connected in pairs to two flues 13 connected to the main flue 16.

169,884. Treatment of aluminium alloys. Brunskill, W. B., 21, Jutland Avenue, Cark-in-Cartmel, Lancashire. August 18, 1920, Nos. 24035 and 32738.

To prevent surface corrosion, aluminium alloys in which aluminium predominates, and particularly those containing copper, manganese, and magnesium, are first boiled in an alkaline solution, such as of caustic soda, then treated in a steam bath, then immersed in a solution of zinc phosphate containing iron phosphate in suspension and of gradually increasing temperature, and finally washed in hot water. The first step may be effected in a water-jacketed porcelain vessel heated to 71 to 82 deg. C., the article being boiled in a caustic soda solution of ½ per cent. strength for about twenty minutes until a black oxide is formed. Preferably the vessel is heated in a gas oven with a ventilating flue so that the article can be quickly dried on withdrawal from the solution, with the aid, if necessary, of a warm jet of compressed air. The article is then suspended in a steam bath for a few minutes only until the coating becomes greenish yellow. Ammonia in small regulated quantity is introduced to prevent acidity during the steaming. A paste formed by the treatment of granular zinc with specified proportions of orthophosphoric acid and boiling water is dissolved in water, one ounce to one gallon, and the solution is boiled in an iron tank for a few hours daily with small additions of the paste, pieces of scrap iron or steel being suspended in the solution. Equal parts of the residual liquor and cold water, with a small quantity of a saturated solution of the paste, form the phosphate solution into which the article is immersed direct from the steaming for ten to fifteen minutes. The coating changes in colour to grey and finally pink, if the solution becomes stronger, and when all the yellow has disappeared the article is washed.

Correspondence.

[*We accept no responsibility for the statements made or the opinions expressed by our correspondents.*]

To the Editor of The Foundry Trade Journal.

Dear Sir,—In your report of the discussion following the Paper on "Electron Metal," read before the Lancashire Branch, I.B.F., on November 5, reference is made to the action of molten aluminium attacking the containing iron crucible.

If any of your readers could give me a suggestion concerning the physical properties and approximate chemical analysis of an iron best suited to withstand this reaction, I should be grateful.—Yours faithfully,

A Member of the Birmingham Branch, I.B.F.

December 13, 1921.

Publications Received.

Messrs. George Philip & Son, Limited, 32, Fleet Street, London, E.C.4. "The Imperial Institute Map of the Chief Sources of Metals in the British Empire, with diagrams of production for 1918." The map has been prepared under the direction of the Mineral Resources Committee of the Imperial Institute, size 35½ by 44 in. Prices: Paper 5s. 6d., and mounted on cloth, rollers and varnished, 12s. 6d. net.

Economic Truth Series, Tract III. "Why is Capital Attacked?" Published by the Liberty and Property Defence League, 25, Victoria Street, Westminster, S.W.1.

A meeting of the Institution of Production Engineers will be held at 7.30 p.m., December 30, at the Institution of Mechanical Engineers, Storey's Gate, London, S.W., when Mr. G. H. Hales, works manager of Messrs. Drummond Bros., Limited, Guildford, will deliver a Paper, to be illustrated by lantern slides, dealing with "The Costing System and its Relation to Production."

Trade Talk.

MONIFIETH FOUNDRY (Jas. F. Low & Company, Limited) has been closed down until January 5.

BEFORE the Leeds Association of Engineers, on December 15, Mr. G. Taylor lectured on the evolution of the file.

SHEFFIELD STEEL PRODUCTS (STORES), LIMITED, have opened the first of their new multiple shops in London, at 125, Cannon Street, E.C.

MR. E. POTTER, patent agent and consulting engineer, has removed his Nottingham offices to Commerce Chambers, Parliament Street.

A FIRE occurred recently at the works of John Thompson, Motor Pressings, Limited, Ettingshall, Wolverhampton. Extensive damage was done to an oil store.

THE "MASTA" STEEL WORKS, LIMITED, have temporarily removed their offices from 9, Billiter Square, Billiter Street, E.C.3, to 7, Semley Road, Norbury, S.W.16.

SAND, GLASS AND FOUNDRY MATERIALS (AMALGAMATED), LIMITED, 27, Waterdale, Doncaster, will in future be known as the Yorkshire Amalgamated Products, Limited.

IN ADDITION to starting one of the blast furnaces, the directors of Guest, Keen & Nettlefolds, Limited, intend installing new plant at Dowlais for the manufacture of steel railway sleepers.

AT THE MEETING of the Liverpool Engineering Society, on December 14, the president, Mr. J. B. Wilkie, in the chair, a paper on "Mechanical Cargo Handling" was read by Mr. G. H. Rae.

DURING the recent gale the floating crane "Titan," belonging to Swan, Hunter & Wigham Richardson & Company, Limited, broke adrift, capsized and sank near Jarrow Slake, blocking the fairway of the river.

THE "UNIFLOW" ENGINE was the subject of a lecture given by Mr. A. Rice, of Lincoln, before the members of the Sheffield branch of the Association of Engineering and Shipbuilding Draughtsmen at Sheffield on December 16.

THE PARTICULARS of the shipbuilding output at the 14 yards on the Tyne show that in the present year 67 vessels, of about 373,909 aggregate tons, were launched, as compared with 80 vessels and 369,026 tons in 1920, a reduction of 13 vessels and an increase of 4,883 tons.

CHANGES IN RATES of wages reported as having come into operation in November, in the industries for which statistics are compiled by the Ministry of Labour, resulted in a total reduction of approximately £1,150,000 in the weekly full-time wages of over 3,450,000 workpeople.

"THE FLUIDITY OF MOLTEN METALS" was the subject of a lecture delivered recently, before the members of the Sheffield branch of the Institution of British Foundrymen, by Professor C. H. Desch, Dean of the Faculty of Metallurgy in the University of Sheffield. Mr. John Watson presided.

RETURNS OF ALL the big firms now being to hand, it appears that the blue riband of the shipbuilding world for the largest output remains on the Tyne, but changes hands, Messrs. Armstrong, Whitworth & Company, with a doubled output of 98,000 tons, winning it for the first time.

THE COMMONWEALTH AND DOMINION LINE (London) has sanctioned the resumption of work on the two liners building for them at Messrs. Workman, Clark & Company's Belfast yard. The work has been suspended for nine months, owing to the trade slump. Other owners are expected to follow this example in the New Year.

AN amalgamation has been effected between Bostock & Bramley, Netherton, Huddersfield, and Joshua Buckton & Company, Limited, Leeds. In future the former will supply designs, specifications, etc., for their speed transformers, gearing, etc., which will be manufactured at the works of Messrs. Buckton & Company at Leeds.

A RETURN JUST ISSUED of the total output of tonnage and horse-power by Swan, Hunter & Wigham Richardson from its Tyneside and Wearside yards for the year 1921 shows that 14 merchant ships were launched of a total tonnage of 92,315. Engines were built by the firm at the company's Neptune works at Walker, Newcastle-on-Tyne, of 31,475 horse-power.

MR. J. S. BROUGHTON, who was a "trade lad" in the Royal Carriage Department of the ordnance factories at Woolwich from 1875 to 1882, and who is at present in London on holiday from Denver, Colorado, U.S.A., has placed in the hands of trustees a fund to assist "trade lads" to obtain books and to provide a special "trade lads'" prize.

THE PROBLEM of handling material by mechanical means formed the subject of two papers read on December 16 at the Institution of Mechanical Engineers. The first was read by Mr. Gardiner Mitchell, of Aberdeen, and dealt with conveying and elevating machinery, while that submitted by Mr. R. E. Knight, of London, was on the pneumatic discharge of grain from ships.

MEMBERS OF THE Sorby Scientific Society listened with great interest to a lecture entitled "The Petrology of Refractories," which was delivered recently by Mr. W. J. Rees, F.I.C., at the Church House, Sheffield. Mr. Rees said the development of microscopical research into this branch of science was largely due to the work of Dr. Sorby, whose name their Society was proud to bear.

THIRTY vessels were launched on the River Wear during 1921, with an aggregate tonnage of 153,710. This is not the lowest output on record, as, during the 1908 depression in the shipbuilding industry, the tonnage put out was only 92,022, although the number of vessels launched in that year was 40. Compared with 1920, this year's figures show a decrease of 37 vessels, and 179,625 tons.

AT THE FIRST MEETING of the Provisional Committee of the proposed Institution of Chemical Engineers, recently, Sir Artur MacDougall was elected as chairman. Other working officers appointed were:—Vice-chairman, Mr. W. J. U. Woolcock; hon. treasurer, Mr. F. H. Rogers; hon. secretary, Professor J. W. Hinchley; assistant hon. secretary, Mr. D. M. Newitt; and acting secretary, Mr. A. C. Flint.

THE members of the Yorkshire branch of the Institution of Mechanical Engineers visited the Brown-Firth Research Laboratories recently. They were shown the processes by which John Brown & Company, Limited, and Thos. Firth & Sons, Limited, equip their works with developments arising from scientific investigation. During the afternoon Dr. W. H. Hatfield gave a lecture on "Special Steels and their Properties."

CAPT H. RIALL SANKEY presided at the annual dinner of the Institution of Mechanical Engineers, held on December 15. Those present included Mr. Marconi, Lord Headley, Mr. Stanley Baldwin, Mr. W. B Worthington, Engineer Vice-Admiral Sir George Goodwin, Sir John Dewrance, Sir Herbert J. Creedy, Sir R. T. Glazebrook, Sir F. W. Dyson, Sir John Cadman, Sir Sydney Chapman, Mr. Paul Waterhouse, Mr. Arthur Neal, M.P., Sir Gerard Muntz, Bt., Sir Henry Maybury, and Sir W. H. Bragg.

AN INTERESTING contribution on "Gear Boxes," by Mr. H. F. L. Orcutt, was read before the London Centre of the Institution of Automobile Engineers on December 14, but owing to the short time available for discussion it has been decided to hold an adjourned meeting at 28, Victoria Street, S.W.1, on Thursday, December 29. The Daimler Premium of £25 has been awarded to Mr. E. L. Bass for his paper on "Engine Lubrication," and this paper will be read before the London Centre at the meeting on February 8.

IT MAY INTEREST our readers to learn that French engineering firms of Lorraine district (rolling stock, railway material, etc.) have kindly consented to accept for periods of two or three months a few British engineering students during their summer holidays. Applications in writing, stating age, qualifications, and giving references, will be received (until further notice) by the Hon. Secretary, British Section of Société des Ingénieurs Civils de France, 45, Great Marlborough Street, London, W.1. Some knowledge of the French language is advisable.

THE output from the Belfast shipyards during this year has aggregated thirteen ships of 93,494 tons, while eleven of 150,000 tons have been reconditioned, and five ships of 51,000 tons, which were launched in 1920, have been completed. Workman, Clark & Company, Limited, head the list of new tonnage with nine vessels of 53,638 tons, an increase of 10,185 tons over 1920, Messrs. Harland & Wolff's contribution being four vessels of 39,856 tons, a decrease of 42,254 tons. The machinery output of the two firms in Belfast has risen from 69,250 i.h.p. to 72,850 i.h.p.

THE WORKS OF Bruce Peebles & Company, Limited, are closing from Friday, December 30, until Monday, January 9, 1922. Those of the Midland Electric Manufacturing Company, Limited, Barford Street, Birmingham, will close from December 23 to 29. Ten days will be given by the Northumberland Shipbuilding Company, Howden, the yard closing on Friday, December 23, and reopening on January 4. At Palmers shipyards, Jarrow and Hebburn, work will be resumed on the Wednesday morning of each week. At Messrs. Hawthorn, Leslie & Company's St. Peters Works, the Christmas holidays will extend from December 23 to 28, but for the New Year the works will be closed on December 31 and January 2 only. The following establishments will be closed from December 23 until January 4:—Tyne Iron Shipbuilding Company's Yard, Willington Quay; North-Eastern Marine Engineering Company's works, Wallsend; Wallsend Slipway & Engineering Company's works; Parsons Marine Engineering Company's works, Wallsend. Messrs. Swan, Hunter, Wigham Richardson's shipyard, Wallsend, will close at 5 p.m. on Friday, and restart on Tuesday morning, December 27; and for the New Year will close at 5 p.m. on December 30 and re-open on Wednesday morning, January 4. G. & J. Weir, Limited, will close from December 30 to January 11, and Tangyes, Limited, from December 23 to January 4.

XUM

IRON AND STEEL MARKETS.

Pig-iron.

The closing markets of the expiring year—memorable as one of the most disastrous from the industrial standpoint ever experienced—did not develop any material improvement in the pig-iron position, as had been somewhat confidently anticipated by some optimists in the trade, and with the disappointing announcement of the extent of the reduction in railway freights, a much less hopeful view is now entertained of a revival of active business early in the New Year. Making full allowance for holiday influences, market movements have been more than usually quiet of late, buying being almost entirely restricted to small parcels for immediate requirements, due largely to a greatly decreased demand for foundry consumers. On Tees-side, makers of Cleveland iron are reported as taking a rather more hopeful view of the future, founded, perhaps, on a better volume of inquiry on next year's account, but whether this opinion will be justified after the disclosure of the very meagre concessions offered by the railway authorities must for the present remain problematical. It may, however, be accepted as definite, that the proposed reductions in rail freight of raw material and furnace products will be ineffectual in influencing any general lowering of current pig-iron prices, which would enable Cleveland makers to offer substantial concessions on quotations now ruling, viz.: No. 1 Cleveland 105s., No. 3 Cleveland G.M.B. 100s., No. 4 foundry 95s., No. 4 forge 90s., mottled and white 85s.

Statistics issued by the National Federation of Iron and Steel Manufacturers show a further slight rise in the production of pig-iron in November to 271,800 tons (compared with 235,500 tons in October). This is still much below the production immediately before the coal stoppage, and less than 40 per cent. of the production in the autumn of 1920.

The East Coast hematite market continues fairly steady, but with prices showing an easier tendency. Makers, however, take a hopeful view of the future, and that an early revival of activity in the steel trade will result in a much-increased demand for this quality of iron. For home use and for shipment to foreign ports Nos. 1, 2, and 3 were put at 102s. 6d., but it was possible to shade that figure, and, indeed, orders were said to have been placed at 100s. No. 1 was half-a-crown above mixed Nos.

Finished Iron.

Operations in the finished iron trade have continued on the previous restricted scale, many of the mills remaining idle, with little prospect of resuming until well into the New Year. With the exception of marked bars, which are mostly contract orders, business is without improvement, prospective buyers being evidently disinclined to place fresh specifications in the present unsatisfactory conditions of the market. Associated manufacturers of the commoner grade bars, on the other hand, protest that crown iron at £13 is not a paying proposition, and prefer to let the works remain idle rather than run plants at a loss, while other producers are apparently glad to accept appreciably less than the authorised price to secure orders. The announcement of the reduction in transport freights by the railway companies has been received without enthusiasm by finished iron manufacturers, whose strongly expressed opinion that it will fail as a stimulus to trade revival is fairly unanimous. Foundrymen are much in the same mind on the subject, the heavy impost of the railway rates having without doubt largely contributed to the reduced demand for castings. The West of Scotland bar iron trade is very quiet, and makers should be able to roll off most of their bookings before closing for the New Year holidays. At the most they have only been working from Tuesdays to Fridays, as the demand is small. Continental prices are still on a much lower level than home quotations, but as foreign deliveries are now so very much extended, it is always a matter for consideration whether the advantage in price is beneficial in the long run.

Steel.

Business being practically suspended until the opening of the New Year, there are no market movements of interest to record, the year closing with little change in the unfortunate conditions with which the steel trade is now far too well acquainted to require detailed enumeration. At present, members of the trade are much more interested in future prospects than in retrospective investigations, and in this connection it is satisfactory to learn that steel makers as a body entertain fairly optimistic views on the subject, without, however, any sanguine expectations of an early recovery of world demand. Inquiries, at all events, in somewhat increased volume, confirm this impression, b t much will depend, however, on buyers reversing their policy of buying only small quantities to cover immediate requirements. It is unlikely that buyers will make forward purchases until they believe that prices have fallen as far as they are likely to for the time being; but it is increasingly evident that less confidence is felt in further price reductions, and consumers are keeping closely in touch with the market in order to take advantage of any favourable movement that may develop. At Glasgow there is an inquiry in the market for locomotives. The probability is, if makers can come to terms with their men as to wages reduction, contracts will come to Scotland. Some steel orders are being cleared off before the end of the year. Inquiries from Australia and India are materialising slowly. At Sheffield, inquiries are slightly more plentiful, and some have resulted in satisfactory business being placed. One large open-hearth steel plant is almost in full operation, while an adjacent works is idle. A little more business is being done in railway tyres, but other sections of the railway materials department are stagnant, except for a few repair and renewal departments. Spring departments are extremely quiet, while tool steel firms have very little to do. Cutlery is in a state of depression, except the table cutlery branches, which are still doing fairly well. The production of steel in November is officially estimated at 442,800 tons, the highest output attained since February, but only 50 per cent. of the production of September, 1920.

Scrap.

The Cleveland iron and steel scrap market continues dull, in view of the holidays, and until the new year very little business of any kind is likely to be done. Quotations in the meantime are nominal and unchanged as follows:—Heavy steel scrap, 57s. 6d.; heavy steel turnings, 40s.; c.i. borings, 39s.; heavy cast-iron machinery scrap (ordinary qualities), 75s.; heavy wrought-iron bushelling scrap, 57s. 6d.; ditto, forge iron, 80s. All delivered works.

Tinplates.

Buyers in the tinplate market are only covering their immediate requirements. Quotations ruling at the moment indicate 20s. 3d. to 20s. 6d. basis for coke finish, net cash, f.o.b. Wales, with spot lots commanding 6d. to 1s. a box more money. Wasters are in moderate demand. CW. 28 by 20 cokes are steady at 40s. per box; CW. 14 by 18¾ at 20s. 6d. per box; and CW. 20 by 10 stand at 24s. 6d. per box, all net, f.o.t. at works. Ternes are quiet at 20s. basis, net, f.o.b.

Metals.

Copper.—Pre-holiday markets are not usually associated with an excessive activity in movements, and this year has been no exception to the rule as far as metals are concerned, the week's transactions having been below the average, with prices showing an easier tendency.

Tin.—A rather more active business can be reported in the market for tin, consequent upon recent favourable Eastern advices, a cablegram from Singapore reporting substantial sales at £174 c.i.f., a decline of 10 per cent. from the previous quotation.

Spelter.—The market for this metal has taken a quieter turn of late, but on the whole the tendency has been fairly steady with near dates unchanged, but forward deliveries a shade firmer. January was done at £27 5s., and April at £27 10s. Settlement price, £27 7s. 6d. Recent arrivals here included 700 tons from Norway, 100 tons from Canada, 65 tons from Belgium, and 5 tons from Sweden. New York advices report a fair business passing. 4.85c. East St. Louis appears to be the lowest price for December and is not freely quoted at that. For first quarter of 1922, 4.90c. is bid and 4.95c. asked, though sellers are loth to offer anything beyond February, and the offerings altogether are sparing.

Lead.—A steady business has been done in soft foreign pig, and a fair inquiry is in circulation. Recent arrivals included 900 tons from America, 350 tons from British India, 25 tons from Belgium, and 286 tons from Australia.

THE COMMONWEALTH AND DOMINION SHIPPING LINE OF LONDON have instructed Messrs. Workman, Clark & Company, of Belfast, to resume at the beginning of the year the work of construction on the two liners "Port Campbell" and "Port Auckland," which was stopped last spring. The decision has been taken on the assumption that the cost of construction will soon fall.

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The above is an actual Photograph of a Test-piece bent Cold from the Flat

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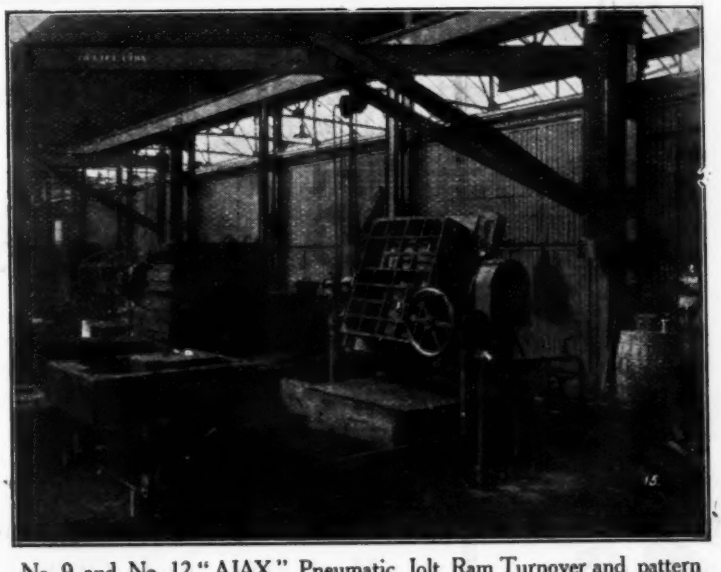

No. 9 and No. 12 "AJAX" Pneumatic Jolt Ram Turnover and pattern drawing moulding machines in the Foundry of a well-known Engineering Company in Manchester. The No. 12 Machine is shown with the turnover table partly turned over.

We should like to send you particulars of these machines.

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Westinghouse Buildings, 2 and 3, Norfolk Street, Strand, LONDON, W.C.2.

Index to Advertisers. page 15. Situations, etc., page 20.

GANISTER, CUPOLA BLOCKS, FIRE BRICKS,
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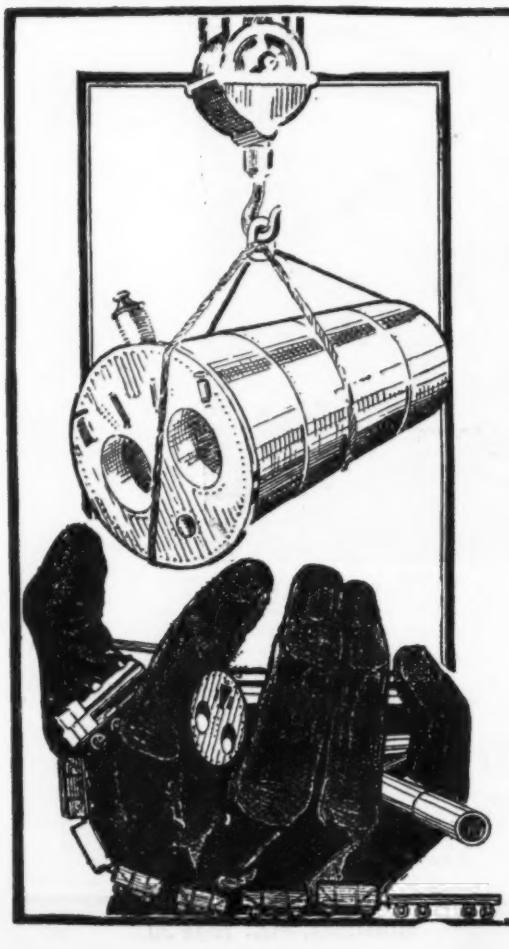
Ground Ganister,
Steel Moulders' Composition,
Silica Bricks, Refractory Goods.

PICKFORD, HOLLAND & Co., Ld., SHEFFIELD.



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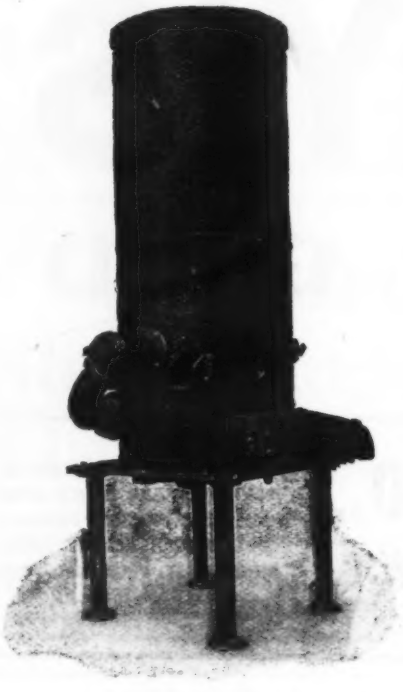
Foundry Plant



O1. Dwarf Cupola.

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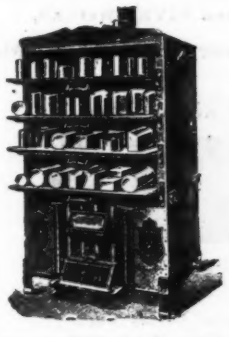

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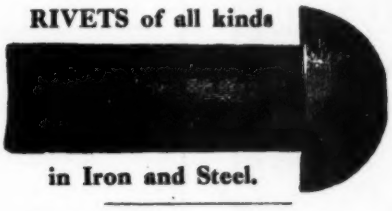
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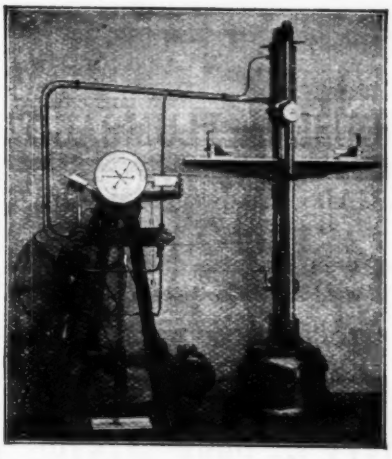

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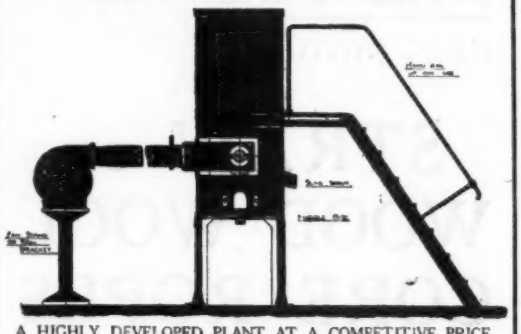

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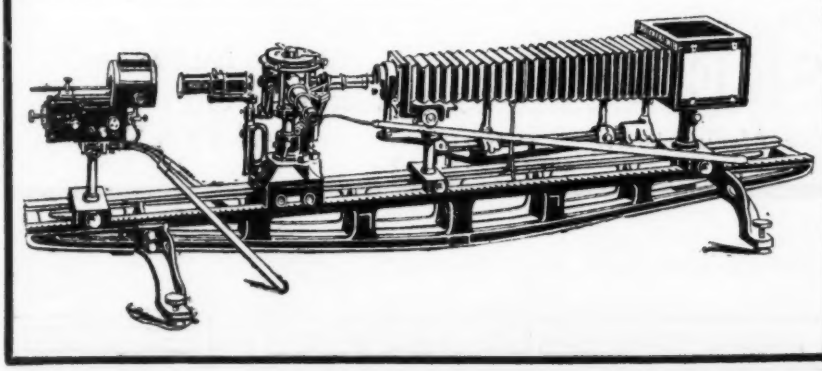

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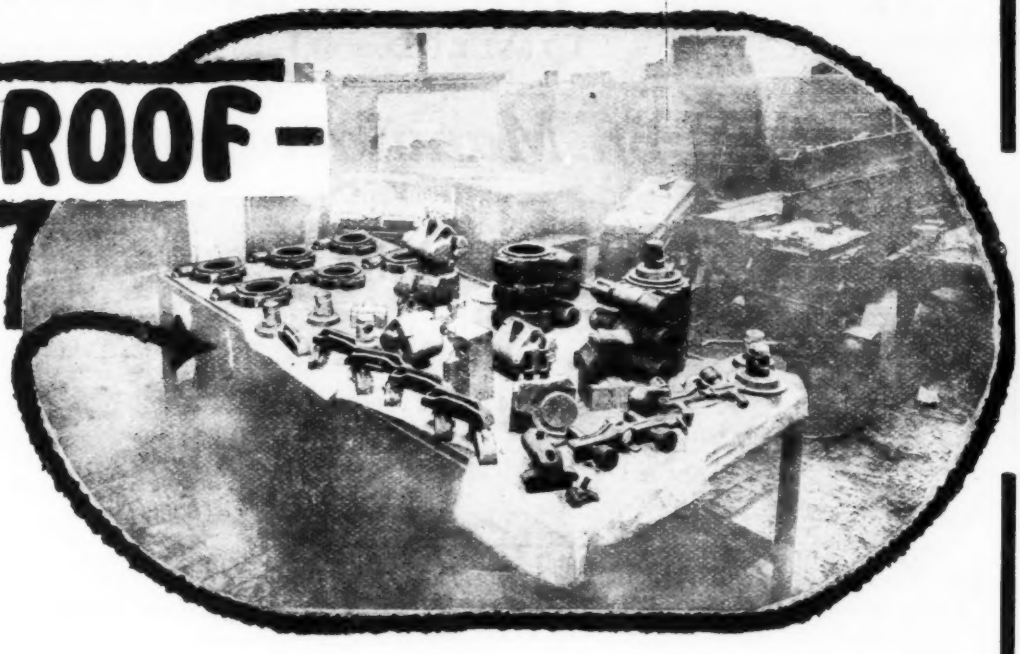

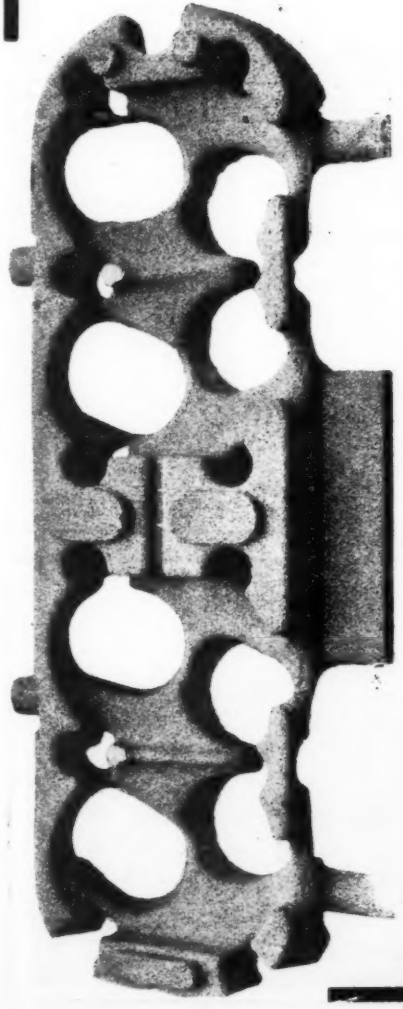

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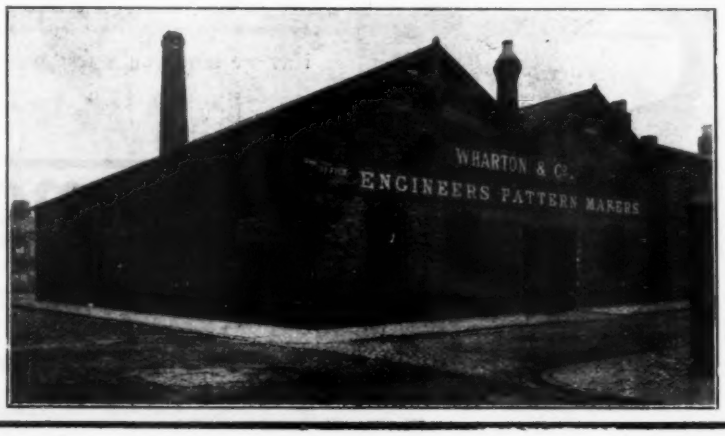

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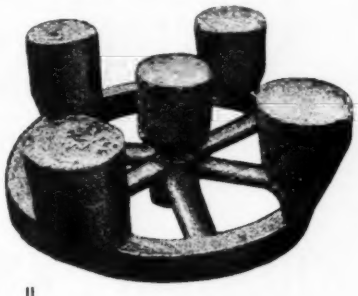

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INDEX TO ADVERTISERS.

	Page
Allan, Thos., & Sons, Ltd.	16
Amsler, Alfred J., & Co.	9
Armitage Works Co.	—
Aske, Wm., & Co.	12
Atlas Diesel Co., Ltd.	—
August's Muffle Furnaces, Ltd.	—
Baldwins, Ltd.	1
Bartoline (Hull), Ltd.	22
Baxter, W. H., Ltd.	—
Beardmore, Wm., & Co., Ltd.	—
Birmingham Corrugated Iron Co., Ltd.	27
Blackfriars Foundry Requisite & Equipment Co.	—
Brealey, W., & Co., Ltd.	27
Britannia Foundry Co.	—
British Industries Fair	—
British Thermit Co., Ltd.	—
Broadbent, T., & Sons, Ltd.	—
Brookes (Oldbury), Ltd.	16
Buckley & Taylor, Ltd.	—
Bullivant & Co., Ltd.	—
Bute Works Supply Co., Ld.	—
Butterworth Bros., Ltd.	25
Cammell, Laird & Co., Ltd.	—
Capper Robson, E., & Co., Ltd.	2
Clay Cross Co., Ltd.	30
Cleveland Magnesite & Refractory Co., Ltd	20
Colville, D., & Sons, Ltd.	22&30
Constructional Eng. Co., Ltd.	—
Cox & Danks	22
Cumming, Wm., & Co., Ltd.	—
Davidson & Co., Ltd.	17
Davies, T., & Son	—
Dearman, E., & Sons	—
Dixon Crucible Co. (The Joseph)	—
Dowler, H. J.	11
Dudley Docker	—
Dudley & Dowell	—
Durrans, J., & Sons	—
Dyson, J. & J.	—
Ellison, George	8
Evans, J., & Co., Ltd.	—
Everitt & Co.	—
Findlay, A., & Co. Ltd.	—
Foster Bros., Ltd.	20
Furmston & Lawlor	20
Fyfe, J. R., & Co.	—
Gadd, Thos.	8
General Refractories Co., Ltd.	1
Gillott, J., & Sons	—
Gledhill Brook Time Recorders, Ltd., The	25
Gossell & Son, Ltd.	—
Grandidge & Mansergh	8
Gray, Thos. E., & Co.	5
Great Central Railway Co.	—
Guest Keen & Nettlefolds, Ltd.	—
Hall, C. E. V.	20
Hall, J., & Co. (Stourbridge), Ltd.	8
Hall, Lewis & Co.	28
Hall & Lund Bros.	16
Harris Bros. (Brierley Hill)	8
Harrison Bros. (England) Ltd	14
Harvey, E. W., Gas Furnace Co., Ltd.	—
Harvey, G. A., & Co. (London), Ltd.	—
Hawkins, W. T., & Co.	—
Hawthorn Leslie & Co., Ltd.	—
Hensall Sand Co.	16
Hill, W. W., Son & Wallace	8
Hesketh, F. W., & Co.	—
Hingley, N., & Sons, Ltd.	25
Hirsch, V.	—
Horie, F. Anthony, & Co.	—
House, Fredk., & Co.	21
Howell & Co., Ltd.	—
Hunt, F. L., & Co.	28
International Abraisives Ltd	10
Jacks, Wm., & Co.	19
Jacks, Wm., & Co., Ltd.	7
James, Wm.	11
Jones, Geo., Ltd.	7
Keith (James) & Blackman Co., Ltd.	—
King Bros. (Stourbridge), Ltd.	27
Lawson, Walton & Co.	24
Legge, F. Thompson & Co.	—
Le Personne, L., & Co.	—
Leys Malleable Castings Co., Ltd.	3
Lloyds Ironstone Co., Ltd.	—
Longden, G., & Son	—
Lowood, J. Grayson, & Co., Ltd.	4
Macdonald, John, & Co.	—
Macdonald, John, & Son, Ltd.	3
Macnab & Co.	—
McLain System (Inc.)	15
McNeil, Chas, Ltd.	—
Mansfield Sand Co.	—
Marple & Gillott, Ltd.	4
Martin, Wm., Sons & Co.	—
Moenich, O., & Co., Ltd.	24
Montrose & Partners	—
Moorwood, Hedley, & Co., Ltd.	5
Motherwell, Wm., & Co.	10
Nineteen-Nineteen Metal Co.	26
Olsen, Wm., Ltd.	10
Parker Winder & Achurch, Ltd.	—
Parkgate Iron & Steel Co., Ltd.	—
Perry, Thos., & Son, Ltd.	24
Phillips, J. W., & C. J.	—
Phœnix Bolt & Nut Co.	22
Pickard, W., & Co.	—
Pickford, Holland & Co., Ld.	4
Portway, C., & Son	7
Potter Cowan & Co.	25
Priest's Furnaces, Ltd.	23
Primrose, T. J.	9
Prior, S. J. Burrell, Ltd.	1
Pnuelec Machine Co., Ltd.	21
Railton, Leonard	—
Ritchie, J. & R., Ltd.	16
Robt. Heath & Lowmoor, Ltd.	19
Roberts, Glazebrook, & Co., Ltd.	—
Roper, E. & Co.	10
Rowat, Alexander & Co., Ltd.	23
Rudolph & Beesley	11
Rustless Iron Co.	27
Sankey, J., & Sons	27
Sankey, J. H., & Son, Ltd.	—
Scottish Iron & Steel Co., Ltd.	—
Shally & Co.	9
Sheet Metal & Galvanizing Co.	9
Shelton Iron, Steel & Coal Co., Ltd.	—
Shore, Douglas W.	—
Shropshire Iron Co., Ld.	23
Silver Sand Co., Ltd., The	11
Smart, H., & H. E.	8
Smith, Albert & Co.	—
Smith, Edward, Ltd.	1
Smith, F., & Co. (Wire Mfs.) Ltd.	—
Smith, John, Ltd.	1
Smith & McLean, Ltd.	29
Smith Stamping Works, Ltd.	—
Spermolin, Ltd.	13
Standard Sand Co.	10
Staveley Coal & Iron Co. Ld.	14
Steel Co. of Scotland, Ltd.	30
Stephens & Co.	8
Stevenson, J., Ltd.	22
Stewart, D., & Co., Ltd.	—
Stewarts & Lloyds, Ltd.	30
Sturtevant Eng. Co., Ltd.	—
Tallis, E.	—
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Tennent, R. B., Ltd.	21 & 24
Thermit, Ltd.	2
Thompson, G.	—
Thwaites Bros., Ltd.	6
Tisdale & Co.	—
Townley, E., & Sons	—
Trist, Ronald, & Co., Ltd.	1
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Walker, I. & I.	27
Ward, T. W., Ltd.	—
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Westinghouse Brake & Saxby Signal Co., Ltd.	—
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West Midland Refining Co.	21
Wharton & Co.	14
Wheatley, Kirk, Price & Co.	16
Whittaker, W., & Sons	—
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Wilkie, A. H.	14
Wilkes, Son & Mappiebeck, Ltd.	—
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Woodward Bros. & Copelin Ltd.	11
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AUCTIONS &
ARBITRATIONS

Engineering, Shipbuilding,
Steel and Iron Works,
&c., &c.,

WHEATLEY KIRK,
PRICE & CO.

Established 1850.

46, Watling Street, London, E.C.4.
16, Albert Square, Manchester.
26, Collingwood Street, Newcastle-on-Tyne.

BROOKES
(OLDBURY), LTD.
BIRMINGHAM.
PATTERN MAKERS

IN WOOD : CAST-IRON : AND
THE : NON-FERROUS : ALLOYS.

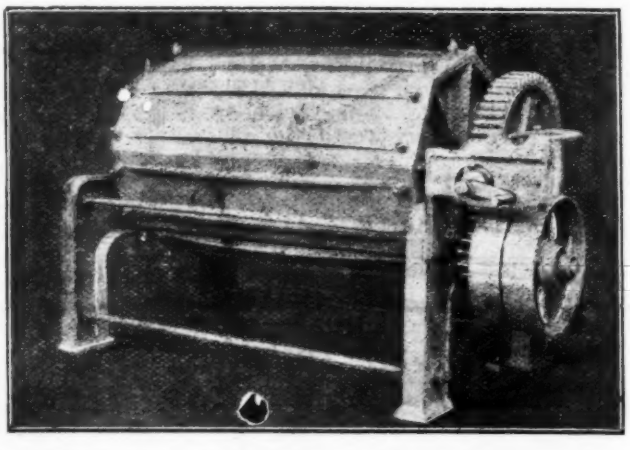
PATTERN PLATES FOR
FLOOR AND MACHINE.

Nothing too Big.
Nothing too Small.

HALL & LUND
BROS.,

OTLEY STREET.
KEIGHLEY.

FOUNDRY
ENGINEERS.



SPECIALITIES :—

TUMBLING BARRELS.
MOULDING MACHINES.
POWER RIDDLES.
EMERY GRINDERS.

SEND FOR FULL PARTICULARS.

THE
HENSALL
SAND Co.,
HENSALL, Nr. GOOLE, YORKS.

BEST RED MOULDING SANDS.

BUILDING, LOCO AND
SEA SANDS.

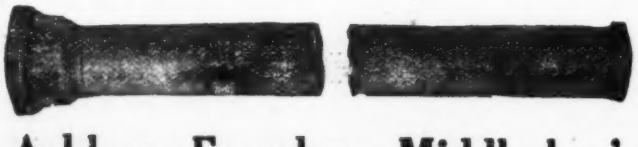
FOUNDRY COKE.
GANISTER. PIG IRON.

CAST IRON FLANGED
PIPES

2 in. to 12 in. Bore.

THOMAS ALLAN & SONS, LTD.,
Bonlea Foundry, Thornaby-on-Tees.

James & Ronald Ritchie,
LTD.



Acklam Foundry, Middlesbro'

Manufacturers of
Cast Iron Pipes
and Fittings.
FLANGED PIPES
A SPECIALITY.
Telegrams :
"RITCHIE, MIDDLESBROUGH."

Company News.

Cohen Steel Company, Limited.—Capital £5,000 in £1 shares.

Le Duc & Kesterton, Limited.—Capital £5,000 in £1 shares. Brassfounders.

Richardsons, Westgarth & Company, Limited.—Preference dividend, 6 per cent., less tax.

Eltringhams, Limited.—Net profit, £36,640; brought forward, £15,595; carried forward, £39,435; preference dividend paid.

Metals Productions, Limited.—Capital £50,000 in £1 shares. Secretary: H. C. Hankins. Registered office: 62, London Wall, E.C.2.

Atlas Steel Foundry & Engineering Company, Limited.—Profit, £14,780; brought forward, £3,783; depreciation, £5,000; general reserve, £2,500; dividend. 7½ per cent., free of tax; carried forward, £5,438.

Blockley Electrical Engineering Company, Limited.—Capital £1,000 in £1 shares. Directors: A. E. Beck and L. A. Beck. Registered office: The Electricity Works, Blockley, Worcs.

Caldwell & Almond, Limited.—Capital £6,000. Manufacturers, machinists, engine builders, etc. Directors: C. C. Prynn and F. Giles. Registered office: 92, Cambridge Street, Plymouth, Devon.

Ernest Hindmarsh & Company, Limited.—Capital £10,000 in £1 shares (8,000 ordinary and 2,000 10 per cent. cumulative participating preferred). Engineers. Registered office: 58, Shaftesbury Avenue, W.C.

White Brothers & Sons, Limited.—Capital £7,000 in £1 shares. Forgemen. Directors: A. White and C. White. Registered office: Cornbrook Works, Cornbrook, Manchester.

Exeter Engineering Company, Limited.—Capital £2,500 in £1 shares (1,000 20 per cent. cumulative participating first preference, 1,000 20 per cent. cumulative non-participating preference, and 500 ordinary). Directors: J. H. Ward and F. Lynch. Registered office: 1a, Sternhall Lane, Peckham, S.E.15.

Forth Shipbuilding & Engineering Company (1921), Limited.—Capital £315,000 in 300,000 shares of £1 each and 300,000 shares of 1s. each, to adopt an agreement with the Forth Shipbuilding & Engineering Company, Limited (incorporated in 1916).—Directors: J. Tennant Rankin, Sir Thomas G. O. Thurston, H. Laing, R. T. Warwick, and A. S. Mcharg. Registered office: Vickers House, Broadway, Westminster.

French Foundrymen's Association. — This reconstructed body recently met under the presidency of Mons. Dufour, to receive the report prepared by Mons. Ronceray, on the apprenticeship question. This was unanimously adopted, and, as a result, further representations are to be made to the Government.

Gazette.

A WINDING-UP order has been made against the Townmead Engineering Works, Limited, 25, Victoria Street, Westminster, S.W.

MESSRS. J. W. HILL & H. WILKS, brass founders, Silver Cross Street, Dewsbury Road, Leeds, trading under the style of J. W. Hill & Company, have dissolved partnership. Mr. H. Wilks continues.

THE NATIONAL ROTARY PUMP COMPANY, LIMITED, is being wound up voluntarily. Mr. F. Morse, 1 and 2, Great Winchester Street, London, E.C.2, has been appointed liquidator.

THE PARTNERSHIP heretofore subsisting between Messrs. C. H S. Naylor and J. E. Bradley, 53, Regent Road, Morecambe, under the style of the Manchester Electric Repairing and Maintenance Company, has been dissolved.

MESSRS. G. H. FENELEY AND H. T. BLOOD, mechanical and electrical engineers, 40a, Windsor Bridge, Salford, and Hawthorn Road, Hale, trading under the style of Feneley & Company, have dissolved partnership.

THE PARTNERSHIP heretofore subsisting between Messrs. A. Towle, W. G. Francis and H. Mote, engineers' patterr makers, Carlton Works, 132a, Much Park Street, Coventry, under the style of the Vulcan Pattern Making Company, has been dissolved.

Applications for Trade Marks.

The following list of applications to register trade marks is extracted from the TRADE MARKS JOURNAL,

"PERSEVERANCE."—All goods included in classes 6, 8, and 13. Gilbert Engineering Company, 33, Kings Road, Hay Mills, Birmingham.

"SCARAB" (design).—Burners for liquid fuel. The Scarab Oil Burning Company, Limited, 28, Charles Street, Haymarket, London, S.W.1.

Personal.

THE LATE Mr. G. F Calderwood. ironfounder, of Iddersleigh, Fairfield, Manchester, left £23,103.

THE LATE MR. C. K. WELTON, of Cook, Welton & Gemmell, shipbuilders, Beverley and Hull, left £14,071.

MR. H. WILLSON, yard manager to Barclay, Curle & Company, Limited, Scotstoun, Glasgow, succeeds Mr N. M. Hunter as general manager.

MR. B. GAMBLE, goods manager of the Great Northern Railway (Ireland), has been elected chairman of the Irish and English Goods Traffic Conference for next year.

"Coal Economy is in the Air"

On the one hand

Natural Draught with costly brick chimney emitting black smoke that spells waste and the draught at the mercy of the atmospheric conditions.

Send for Catalogue No. 1009.

On the other hand

SIROCCO

Induced Draft with inexpensive steel stack and no wasteful smoke because the Fan ensures perfect combustion and correct draught at all times.

DAVIDSON & CO LTD.

SIROCCO WORKS, BELFAST.

TRADE SIROCCO MARK

WEEKLY PRICE CURRENT.

COPPER.

	£	s	d
Standard cash	66	5	0
Three months	67	5	0
Electrolytic	74	10	0
Tough	67	10	0
Best selected	68	5	0
Sheets	98	0	0
India	93	0	0
Wire bars	75	5	0
Do. Jan.	75	5	0
Do. Feb.	75	5	0
Ingot bars	74	15	0
H.C. wire rods	80	15	0
Off. aver. cash, Nov.	66	13	6 3/11
Do. 3 mths., Nov.	67	9	9 3/11
Do. Settlement Nov.	66	12	7 3/11
Do. Electro, Nov	75	6	9 9/11
Do. B.S., Nov.	68	6	1 1/3
Aver. spot, copper, Nov.	66	12	6½
Do. Electro, Nov.	76	5	11

Solid drawn tubes .. 14½d.
Brazed tubes .. .. 14½d.
Wire .. .. .. 11d.
Yellow metal rods .. 6¾d.
Do. 4x4 Squares .. 9d.
Do. 4x3 Sheets .. 9d

BRASS.

Solid drawn tubes .. 12½d.
Brazed tubes 14½d
Rods .. .. .. 11½d.
Sheets to 10 w.g. .. 11½d.
Wire .. .. .. 11½d.
Rolled metal .. 10¾d.

TIN.

Standard cash	172	5	0
Three Months	174	5	0
English	172	0	0
Bars	174	0	0
Chinese	172	15	0
Straits	174	5	0
Australian	173	10	0
Eastern	173	10	0
Banca	173	5	0
Off. aver., cash, Nov.	159	0	2 1/22
Do. 3 mths., Nov.	160	19	5 19/22
Do. Stlment. Nov.	158	18	6 8/11
Aver. spot, Nov	158	18	5

SPELTER.

Ordinary	27	7	6
Remelted	25	0	0
Hard	18	10	0
Electro 99.9	31	0	0
English	29	0	0
India	22	0	0
Prime Western	28	12	6
Zinc dust	45	0	0
Zinc ashes	5	0	0
Off. aver., Nov.	26	4	10 7/11
Aver., spot, Nov.	25	18	6½

LEAD.

Soft foreign ppt	24	8	9
English	26	0	0
Off. average, Nov.	24	4	10 7/11
Average spot, Nov	24	9	8

ZINC SHEETS.

Zinc sheets, spot	34	0	0
Do. V.M. ex. whf	35	0	0
Do. ppt., t.o.b., N.Y.			—
Dutch	34	0	0
Boiler plates	33	0	0
Battery plates	32	10	0

ANTIMONY.

English regulus	35	0	0
Special brands	36	10	0
Chinese	24	10	0
Crude	17	0	0

QUICKSILVER.

Quicksilver 10 10 0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—
45/50% 12 17 6
75% 21 0 0

Ferro-vanadium—
35/40% .. 20/6 lb. va.

Ferro-molybdenum—
70/80% .. 6/9 lb. mo.

Ferro-titanium—
23/25%, carbonless 1/3 lb.

Ferro-phosphorus, 20/23%, £18

Ferro-tungsten—
80/85%, carbon free 1/5 lb.

Tungsten metal powder—
98/99% .. .. 1/8 lb.

Ferro-chrome—
4/6% car. £26 0
6/8% car. £25 10
8/10% car. .. £24 10

Ferro-chrome—
Max. 2% car. .. £75
Max. 1% car. .. £91
Max. 0.70% car. .. £106
67/70%, carbonless 2/1 lb.

Nickel—99%, cubes or pellets .. £180

Cobalt metal—98/99% 14/- lb.

Aluminium—98/99% £120

Metallic Chromium—
96/98% .. .. 5/3 lb.

Ferro-manganese—
76/80%, loose .. £15
76/80%, packed .. £16
76/80%, export .. £14 10

Metallic manganese—
94/96%, carbonless 2/4 lb.
Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten .. .. s. d. 2 8

Finished bars, 18% tungsten 3

Per lb. net, d/d buyers' works.

Extras—
Rounds and squares 3 in. to 8 in. inclusive 4d. lb.
Rounds and squares under ½ in. to ¼ in. 3d. lb.
Flats under 1 in. by ¾ in. to ¼ in. by ¼ in., and all sizes over four times in width over thickness .. .. 3d. lb.
Bevels of approved sizes and sections .. 6d. lb.
If in coils .. .. 3d. lb.
Packing .. .. 5s. cwt
Bars cut to length 10% extra

Scrap from high-speed tool steel—
Scrap pieces .. .. 5d.
Turnings and swarf .. 2d.

Per lb. net, d/d steel makers' works.

SCRAP.

South Wales—	£	s.	d.	£	s.	d.
Heavy Steel	3	6	0	3	12	6
Bundled steel & shearings				2	12	6
Mixed iron & steel	1	12	6	3	2	6
Heavy cast iron				3	2	6
Good machinery for foundries				4	12	6

Cleveland—			
Heavy steel	2	17	6
Steel turnings	2	0	0
Cast-iron borings	1	19	0
Heavy wrought iron piling	4	0	0
Bundling scrap	2	17	6
Cast-iron scrap	3	15	0

Lancashire—			
Cast iron scrap	4	10	0
Heavy wrought	3	5	0
Steel turnings	2	5	0

London—	£	s.	d.
Copper (clean)	53	0	0
Brass (clean)	26	0	0
Lead (less usual draft)	22	0	0
Tea lead	20	0	0
Zinc	14	10	0
New aluminium cuttings	60	0	0
Braziery copper	43	0	0
Gun metal	38	0	0
Hollow pewter	115	0	0
Shaped black pewter	75	0	0

GANISTER.

Plastic 25/-
Dry 20/-

PIG-IRON.

N. E. Coast—	
Foundry No. 1	105/-
Foundry No. 3	100/-
Forge No. 4	90/-
Mottled	85/-
Hematite No. 1	102/6
Hematite M/Nos.	100/-

Midlands—	
Staffs. common	145/-
„ part-mine forge	160/-
„ „ foundry	180/-
„ Cold blast	nominal
„ basic	—
Northants forge	85/-
„ foundry No. 3	92/6
„ basic	—
Derbyshire forge	87/6
„ foundry No. 3	97/6
„ basic	—

Scotland—	
Foundry No. 1	120/-
„ No. 3	115/-
Hematite M/Nos.	120/-

Sheffield (d/d district)—	
Derby forge	100/-
„ foundry No. 3	103/-
„ basic	—
Lincs. forge	—
„ foundry No. 3	—
„ basic	—
E.C. hematite	113-
W.C. hematite	125/-

All d/d in the district.

Lancashire (d/d eq. Man.) —	
Derby forge	—
„ foundry No. 3	—
Northants foundry No. 3	—
Cleveland foundry No. 3	—
Staffs. foundry No. 3	—
Lincs. forge	—
„ foundry No. 3	—
Summerlee foundry	138/3
Glengarnock foundry	143/3
Gartsherrie foundry	138/3
Monkland foundry	138/3

FINISHED IRON & STEEL.

Iron—	£	s.	d.
Bars (crown)	13	0	0
Angles	13	10	0
Tees to 3 united ins.	14	0	0
Nut and bolt	13	0	0
Hoops	16	5	0
Marked bars (Staffs.)	16	0	0
Gas strip	13	10	0
Bolts and nuts, ¾ in. × 4 in.	23	0	0

Steel—			
Ship plates	10	10	0
Boiler plates	14	10	0
Chequer plates	11	10	0
Angles	9	10	0
Tees	10	10	0
Channels	9	5	0
Joists	10	0	0
Rounds, ¾ in.–3-in.	11	0	0
Rounds, 3 in.–5½ in.	10	10	0
Flats, 5 in.–8 in.	12	0	0
Flats over 8 in.	12	0	0

	£	s.	d
Rails, heavy	9	10	0
Fishplates	14	10	0
Hoops	12	10	0
Black sheets, 24 g.	14	0	0
Galv. cor. sheets, 24 g.	17	0	0
Galv. fencing wire, 8 g. plain	17	10	0
Rivets, ¾ in. dia	17	10	0
Billets, soft	7	5	0
Billets, hard	8	5	0
Sheet and tin bars	7	15	0

PHOSPHOR BRONZE.

	Per lb basis.
Strip	1 5½
Sheet	1 5½
Wire	1 5½
Rods	1 4½
Tubes	1 7½
Castings	1 2

Delivery 3 cwt. free to any town.
10% phosphor copper, £40 above price of B.S.
15% phosphor copper, £50 above price of B.S.
Phosphor tin (5%), £30 above price of English ingots.

CHARLES CLIFFORD & SON, LIMITED, BIRMINGHAM.

NICKEL SILVER, SHEET METAL, WIRE AND TUBES.

	Per lb.
Ingots for raising	1/- to 1/6
Rolled—	
To 9 in. wide	1/7 to 2/1
To 12 in. wide	1/7½ to 2/1½
To 15 in. wide	1/8½ to 2/2½
To 18 in. wide	1/9½ to 2/3½
To 21 in. wide	1/10½ to 2/4½
To 24 in. wide	1/11½ to 2/5½
Ingots for spoons and forks	1/- to 1/6
Ingots rolled to spoon size	1/3 to 1/9
Wire round—	
3/0 to 10. G.	1/9½ to 2/4½

with extras according to gauge

AMERICAN IRON & STEEL.

At Pittsburgh unless otherwise stated.	Dols.
No. 2X foundry, Phila.	22.26
No. 2 foundry Valley	20.50
No. 2 foundry, Birm.	17.50
Basic	20.96
Bessemer	21.96
Malleable	21.96
Grey forge	21.46
Ferro-manganese 80 % delivered	60.00
Bess. rails, h'y, at mill	40.00
O.-h. rails, h'y, at mill	40.00
Bess. billets	29.00
O.-h. billets	29.00
O.-h. sheet bars	30.00
Wire rods	38.00
	Cents.
Iron bars, Phila.	1.95
Steel bars	1.50
Tank plates	1.50
Beams, etc.	1.50
Skelp, grooved steel	1.60
Skelp, sheared steel	1.60
Steel hoops	2.00
Sheets, black, No. 28	3.00
Sheets, galv., No. 28	4.00
Sheets, blue an'l'd, 9&10	2.25
Wire nails	2.75
Plain wire	2.50
Barbed wire, galv.	3.40
Tinplate, 100-lb. box	$4.65

COKE.

Welsh foundry	37/6	42/6
„ furnace	20/-	25/-
Durham & North. foundry	37/6	
„ furnace	20/-	25/-
Other Districts, foundry	50/-	
„ furnace	23/-	

SWEDISH IRON.

Bars, hammered basis sizes Basis price £26 to £28

	£ s. d.
Rolled Ordinary—Assortment ..	18 0 0 to 19 0 0
Nail Rods—Square, round and flats ..	
Keg Steel	nom. £38 to £40
Faggot Steel	nom. £30 to £32
Blooms—Single welded ..	£12 to £14
Billets—Single and double welded	£14 to £15
Pig-Iron—Grey, white or mottled	£9 0 0 to £9 10 0

Prices are without engagement. All quotations are f.o.b. Gothenburg, net cash against documents there.

TUBES.

	Up to and incl. 2 in.	Over 2 in.
Gas ..	—37½%	—40%
Water ..	—30%	—32½%
Steam ..	—22½%	—25%

TINPLATES.

I.C.Cokes,	20×14, box	20/6
,,	28×20, ,,	41/-
,,	20×10, ,,	29/6
,,	18¾×14, ,,	23/6
I.X.	,,	45/-
I.X.X.	,,	50/-
F.C.B.Y.	21×13⅝ ,,	42/6
C.V.B.G.	16×15, ,,	42/9
I.C.W.	20×14, ,,	19/6
,,	28×20, ,,	40/-
,,	20×10, ,,	24/6
,,	18¾×14, ,,	20/6
Terneplates,	28×20, ,,	40/-

DAILY FLUCTUATIONS.

Standard Copper (cash).

	£	s.	d.	
Dec. 21	66	12	6	No change
,, 22	66	5	0	dec. 7/6
,, 23	66	5	0	No change
26 & 27		—		
Dec. 28	66	5	0	No change

Electrolytic Copper.

Dec. 21	74	10	0	No change
,, 22	74	10	0	,,
,, 23	74	10	0	,,
26 & 27		—		
Dec. 28	74	10	0	No change

Standard Tin (cash).

Dec. 21	171	7	6	dec. 2/6
,, 22	170	15	0	,, 12/6
,, 23	170	15	0	No change
26 & 27		—		
Dec. 28	172	5	0	inc. 30/-

Tin (English ingots)

Dec. 21	170	10	0	Dec. 20/-
Dec. 22	170	0	0	dec. 10/-
,, 23	170	0	0	No change
26 & 27		—		
Dec. 28	172	0	0	inc. 40/-

Zinc Sheets (spot).

Dec. 21	35	0	0	No change
,, 22	34	10	0	dec. 10/-
,, 23	34	10	0	No change
26 & 27		—		
Dec. 28	34	0	0	dec. 10/-

Spelter (ordinary).

Dec. 21	27	12	6	No change
,, 22	27	10	0	dec. 2/6
,, 23	27	7	6	,, 2/6
26 & 27		—		
Dec. 28	27	7	6	No change

Lead (English).

Dec. 21	26	15	0	dec. 5/-
,, 22	26	15	0	No change
,, 23	27	0	0	inc. 5/-
26 & 27		—		
Dec. 28	26	0	0	dec. 20/-

CARBOLON

Absolutely Efficient!

the hardest and most durable of all known Abrasives: the finest quality Silicon Carbide ever produced. Owing to its *rapid* and *uniform* abrading properties, it is the *Best Abrasive for Cast Iron, Brass, Bronze, Copper and Aluminium.*

INTERNATIONAL ABRASIVES LIMITED

also manufacture CARBOLON SCOURING AND RUBBING BRICKS AND STONES in a great variety of shapes and sizes for *cleaning and scouring castings, etc.*

CARBOLON STICKS, Round, Half-round, Triangular and Square, for Mould and Die Cleaning; hard, sharp and fast in cutting. They retain their shape and cutting capacity to the last.

GRINDING WHEELS of all descriptions.

STEEL SHOT FOR SANDBLASTING—Round and Crushed, and all Apparatus and Appliances for Sandblasting purposes. CARBOLON REFRACTORIES for Furnace and Cupola Linings, Floor Hardening, etc.

INTERNATIONAL ABRASIVES, Ltd., Middlesbrough.

ROBERT HEATH & LOW MOOR, LTD.,
STOKE-ON-TRENT.

Best Foundry Coke,
PIG IRON, Cold and Hot Blast Cylinder, Foundry and Basic.
Finished Bars in Iron and Mild Steel.

Brands—

Lowmoor (Best Yorkshire).
B B H
R H★

Rounds	up to 7½" dia.	Tees	up to 5" x 4"
Squares	,, ,, 6"	Channels	up to 10" x 3½"
Flats	,, ,, 10" wide	Joists	,, ,, 6" x 4½"
Angles	,, ,, 8" x 3½"	Rails	,, ,, 40 lbs. per yd
Hoops	,, ,, 6½" wide	Plates.	

WILLIAM JACKS & COMPANY,
5, EAST INDIA AVENUE, LONDON, E.C.

Telegrams: ALKALIZE, BIRMINGHAM.
Telephone: CENTRAL 1175 & 1176
Birmingham Office:
18, BENNETT'S HILL.

Telegrams: ALKALIZE, LONDON.
Telephone: 7880 AVENUE (3 lines.
Head Office:
5, EAST INDIA AVENUE, London, E.C.

REGISTERED TRADE MARK

PIG IRON.

Scotch, Middlesbro,' Hematite, Basic, Specials, &c., &c.

TIN — SPELTER — CHROME
COPPER — ANTIMONY—MANGANESE.

WILLIAM COLVIN & COMPANY,

ROYAL EXCHANGE, MIDDLESBROUGH

93, HOPE STREET, GLASGOW.

SITUATIONS VACANT AND WANTED.

WORKING FOREMAN MOULDER, abreast with the times, age 37, live and active, seeks Situation; any district; prepared to invest small capital.—Particulars, Box 968, Offices of the FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

FOUNDRY Foreman wants position; can get best results from cupola, plant and men; 20 years at jobbing, plate and machine; used to castings of uneven sections; good references; member I.B.F.—Box 962, Offices of the FOUNDRY TRADE JOURNAL, 5, Duke Street, Adelphi, London, W.C.2.

CHILLED and GRAIN ROLL MAKERS require representative; only practical men considered, capable of taking particulars of Mill and Forge Castings.—Reply, stating experience, age, salary required, to Box 966, Offices of the FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, Strand, London, W.C.2.

FOUNDRY UNDER-FOREMAN required; must be practical moulder, capable estimating costs, devising best methods of production of varied work, and getting work out expeditiously. The position is progressive to man of ability.—Give names of previous employers, positions held, age and wage required, to Box 964, Offices of the FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Strand, London, W.C.2.

AGENCY.

EXPORT and Import Dealer, in raw materials and metallurgical products (scrap iron, slags, pyrites, ores, etc.), desires to enter into relations with important English firms.—Write HERVÉ, 1, Rue Kléber, Nantes.

PATENTS.

ADVICE and Handbook Free. — KING'S PATENT AGENCY, LIMITED, Director, B. T. King, Reg. Patent Agent, 146a, Queen Victoria Street, E.C.4.

THE Proprietor of the Patent No. 1479, of 1912, for improvements relating to the manufacture of manganese steel is desirous of entering into arrangements by way of licence and otherwise, on reasonable terms, for the purpose of exploiting the same, and ensuring its full development and practical working in this country.—All communications should be addressed in the first instance to: HASELTINE, LAKE & COMPANY, Chartered Patent Agents, 28, Southampton Buildings, Chancery Lane, London, W.C.2.

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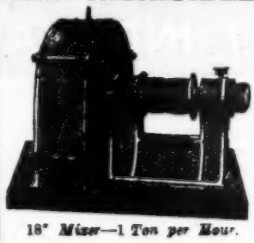

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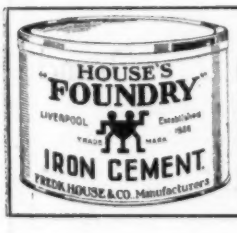

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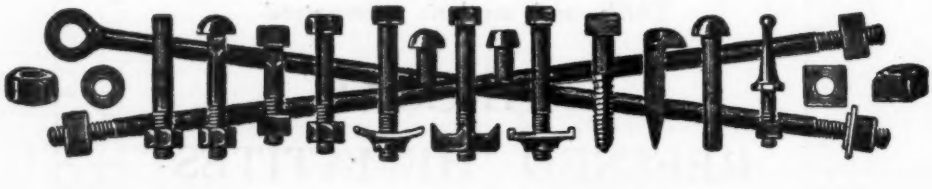

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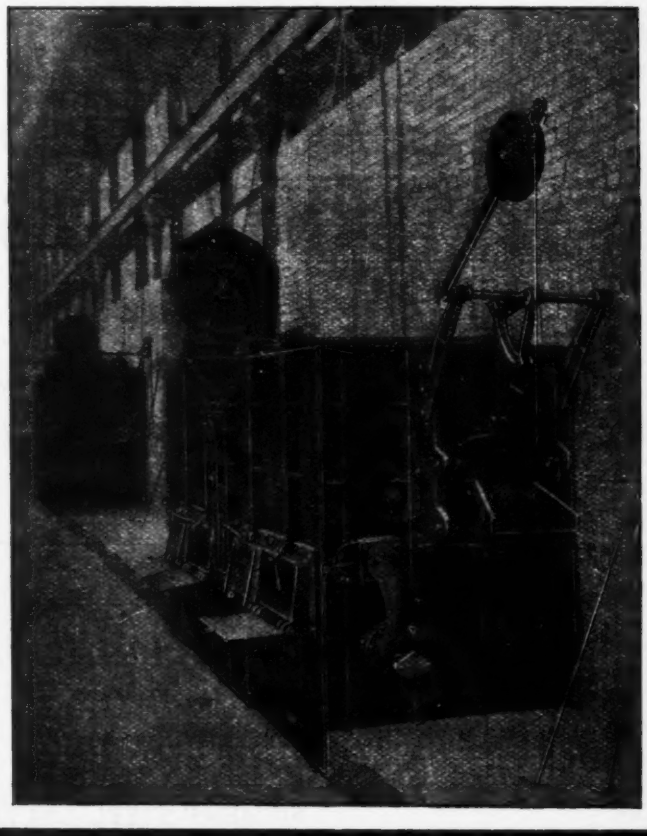

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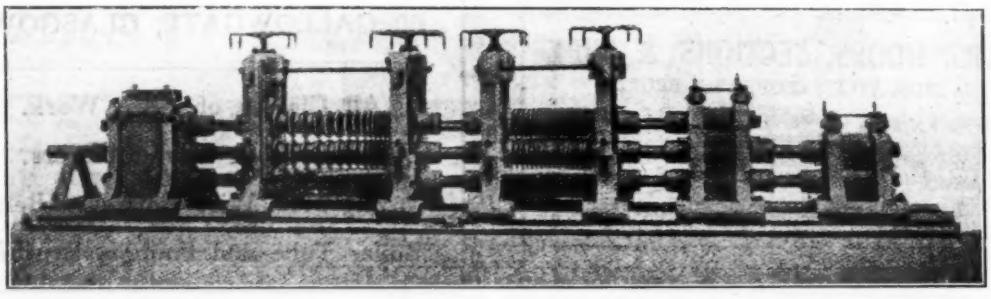

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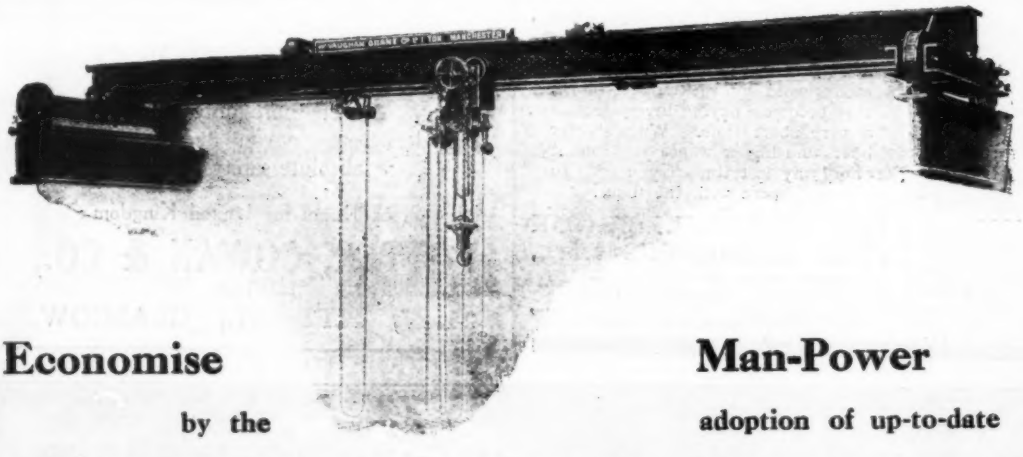

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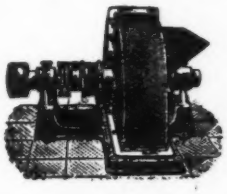

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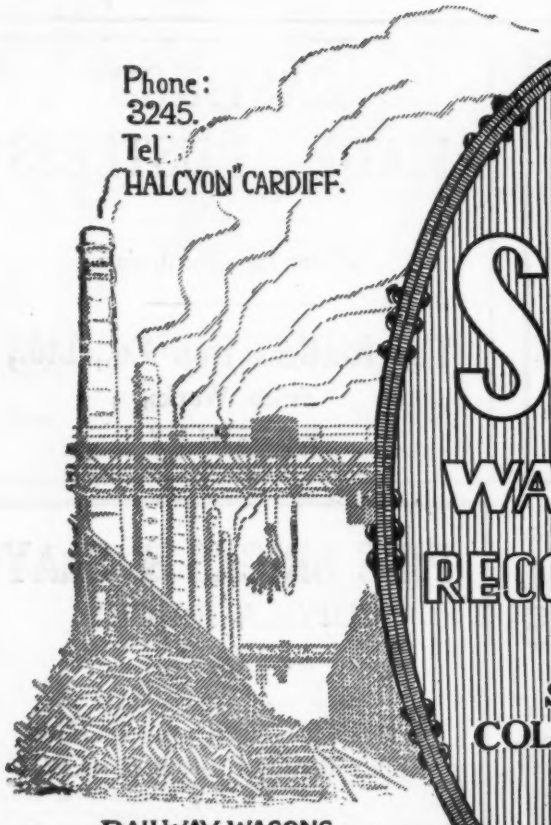

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